

NEC

M100/M300 Disk Array

Configuration Guide

Rev.3.0
21 Dec.2011

Information of disclosure and limitation of usage

NEC Corporation has all the rights about this material. You can not use this material for any purposes other than provided purpose. In addition, you can not duplicate, modify and disclose this material to any third party without permission of NEC Corporation. Meanwhile, we may change the contents of this guide without notice in the future.

NEC Corporation

Rev	Date of revision	Contents of revision
1.0	2011.05.13	First Edition
1.1	2011.05.20	Support SSD Arranged Deleted D.C. Model
1.2	2011.05.26	Product Name Fixed Base Unit accessories fixed
1.3	2011.08.12	NF5321-SF21E Product name fixed
2.0	2011.10.06	M300 Series added
2.1	2011.10.17	DE Production number fixed
2.2	2011.12.01	HDD list updated
3.0	2011.12.21	SAS & Combo Controller supported Dummy HDD added

Table of Contents

1. Specifications	3
2. Component Selection	
– M100 Component Selection	5
– M300 Component Selection	22
3. Rack Guide	40
4. Disk Drive	41
5. Functions	43
Appendix: Dynamic Pool Capacity List	66

1. Specifications <M100>

Item				M100		
Chassis configuration				2.5" HDD: Max. 24 HDDs per controller or disk enclosure unit.		
				3.5" HDD: Max. 12 HDDs per controller or disk enclosure unit.		
				Max. 96 HDDs supported.		
				Up to three disk enclosure units with 2.5" HDD and/or up to seven disk enclosure units with 3.5" HDD can be connected to the controller unit.		
				SAS/NL-SAS/SSD are supported on the same controller and disk enclosure unit. 2.5" and 3.5" mixed HDD environments are not supported on the same controller and disk enclosure unit.		
Host interface / Number of host ports	FC	8Gb x 2/4/8				
	iSCSI (1Gb)	1Gb x 2/4				
	iSCSI (10Gb)	10Gb x 2/4				
	SAS	6Gb x 4/8				
	FCoE	Scheduled to be supported in 2012				
	Intermix	No				
Cache	Capacity	4GB(per cont)				
	Backup time	Unlimited				
Number of controllers				1 or 2		
Disk I/F				SAS 6Gbps x 2		
Disk Drive ^(*1)	SAS	3.5"	300GB(15Krpm), 450GB(15Krpm), 600GB(15Krpm)			
		2.5"	300GB(15Krpm), 300GB(10Krpm), 450GB(10Krpm), 600GB(10Krpm), 900GB(10Krpm)			
	NL-SAS	3.5"	1,000GB(7.2Krpm), 2,000GB(7.2Krpm), 3,000GB(7.2Krpm)			
		2.5"	1,000GB(7.2Krpm)			
SSD	SAS	3.5"	400GB			
		2.5"	100GB			
Disk Enclosure				SAS (Max transfer speed 6Gbps) x 2		
Max. number of disk drives				96 units ^(*2)		
RAID levels	SAS, NL-SAS		0, 1, 5, 6, TM, 10, 50, 60			
	SSD		1, 10, 5(4+P)			
Dimensions	W x D x H mm		482 x 513.2 x 87.8 (2U)			
Weight	with 3.5" HDDs		33kg or less			
Power supply				AC:100 - 240V		
Max Power consumption (W)	DAC	3.5"	FC	485W(SAS15K)	420W(NL-SAS7.2K)	
			1Gb iSCSI	475W(SAS15K)	415W(NL-SAS7.2K)	
			10Gb iSCSI	485W(SAS15K)	420W(NL-SAS7.2K)	
		2.5"	FC	495W(SAS15K)	495W(SAS10K)	460W(NL-SAS7.2K)
			1Gb iSCSI	485W(SAS15K)	490W(SAS10K)	455W(NL-SAS7.2K)
			10Gb iSCSI	495W(SAS15K)	495W(SAS10K)	460W(NL-SAS7.2K)
	DE	3.5"	FC	315W(SAS15K)	250W(NL-SAS7.2K)	
			1Gb iSCSI	315W(SAS15K)	250W(NL-SAS7.2K)	
			10Gb iSCSI	315W(SAS15K)	250W(NL-SAS7.2K)	
		2.5"	FC	310W(SAS15K)	315W(SAS10K)	280W(NL-SAS7.2K)
			1Gb iSCSI	310W(SAS15K)	315W(SAS10K)	280W(NL-SAS7.2K)
			10Gb iSCSI	310W(SAS15K)	315W(SAS10K)	280W(NL-SAS7.2K)
Temperature / Humidity conditions				Operating: 5 to 40°C, 10-80% Stop: -10 to +60°C, 5-80%		
Supported OS		Open OS	Windows2003/2008, RHEL5.5, SUSE10SP3 or later, CentOS5.5			
		Hypervisor	VMware4.1 or later, Hvpvr-V2.0 or later, KVM(RHEL6)			

*1 Support disk encryption for SAS & NL-SAS

*2 Refer to P.17 Component Selection(12) [CAUTION:The Number of Disk Enclosures]

1. Specifications <M300>

Item				M300		
Chassis configuration				3.5" HDD: Max. 12 HDDs per controller or disk enclosure unit. 2.5" HDD: Max. 24 HDDs per controller or disk enclosure unit.		
				3.5" HDD: Max. 96 HDDs supported. 2.5" HDD: Max. 144 HDDs supported.		
				SAS/NL-SAS/SSD are supported on the same controller and disk enclosure unit. 2.5" and 3.5" mixed HDD environments are not supported on the same controller and disk enclosure unit.		
Host interface / Number of host ports	FC		8Gb x 8			
	iSCSI (1Gb)		1Gb x 4			
	iSCSI (10Gb)		10Gb x 4			
	SAS		6Gb x 8			
	FCoE		Scheduled to be supported in 2012			
	Intermix		Supported (8G FC x 4 + 1G iSCSI x 4)			
Cache	Capacity		8G or 16GB			
	Backup Time		Unlimited			
Number of controllers				2		
DAC-DE I/F				6Gbps SAS x 2		
Disk Drive ^(*)	SAS	3.5"	300GB(15Krpm), 450GB(15Krpm), 600GB(15Krpm)			
		2.5"	300GB(15Krpm), 300GB(10Krpm), 450GB(10Krpm), 600GB(10Krpm),			
	NL-SAS	3.5"	1,000GB(7.2Krpm), 2,000GB(7.2Krpm), 3,000GB(7.2Krpm)			
		2.5"	1,000GB(7.2Krpm)			
SSD	SAS	3.5"	400GB			
		2.5"	100GB			
Disk Enclosure				SAS (Max transfer speed 6Gbps) x 2		
Max. number of disk drives				144 units(2.5"), 96 units(3.5") ^(*)		
Max. number of SSD				12 units		
RAID Level	SAS, NL-SAS		0, 1, 5 ,6, TM, 10, 50, 60			
	SSD		1, 10, 5(4+P), 50(4+P)			
Dimensions	W x D x H mm		482 x 513.2 x 87.8 (2U)			
Weight	with 3.5" HDDs		31kg or less			
Power Supply				AC:100 - 240V		
Max Power consumption (W)	DAC	3.5"	FC	500W(SAS15K)	435W(NL-SAS7.2K)	
			1Gb iSCSI	500W(SAS15K)	435W(NL-SAS7.2K)	
			10Gb iSCSI	500W(SAS15K)	435W(NL-SAS7.2K)	
		2.5"	FC	495W(SAS15K)	495W(SAS10K)	460W(NL-SAS7.2K)
			1Gb iSCSI	485W(SAS15K)	490W(SAS10K)	455W(NL-SAS7.2K)
			10Gb iSCSI	495W(SAS15K)	495W(SAS10K)	460W(NL-SAS7.2K)
	DE	3.5"	FC	315W(SAS15K)	250W(NL-SAS7.2K)	
			1Gb iSCSI	315W(SAS15K)	250W(NL-SAS7.2K)	
			10Gb iSCSI	315W(SAS15K)	250W(NL-SAS7.2K)	
		2.5"	FC	310W(SAS15K)	315W(SAS10K)	280W(NL-SAS7.2K)
			1Gb iSCSI	310W(SAS15K)	315W(SAS10K)	280W(NL-SAS7.2K)
			10Gb iSCSI	310W(SAS15K)	315W(SAS10K)	280W(NL-SAS7.2K)
Temperature / Humidity conditions				Operating: 5 to 40°C, 10-80% Stop: -10 to +60°C, 5-80%		
Supported OS	Open OS		Windows2003/2008, RHEL5.5, SUSE10SP3 or later, CentOS5.5, HP-UX, AI*			
	Hypervisor		VMWare4.1 or later, Hyper-V2.0 or later, KVM(RHEL6)			

*1 Support disk encryption for SAS & NL-SAS

*2 Refer to P.34 Component Selection(12) [CAUTION:The Number of Disk Enclosures]

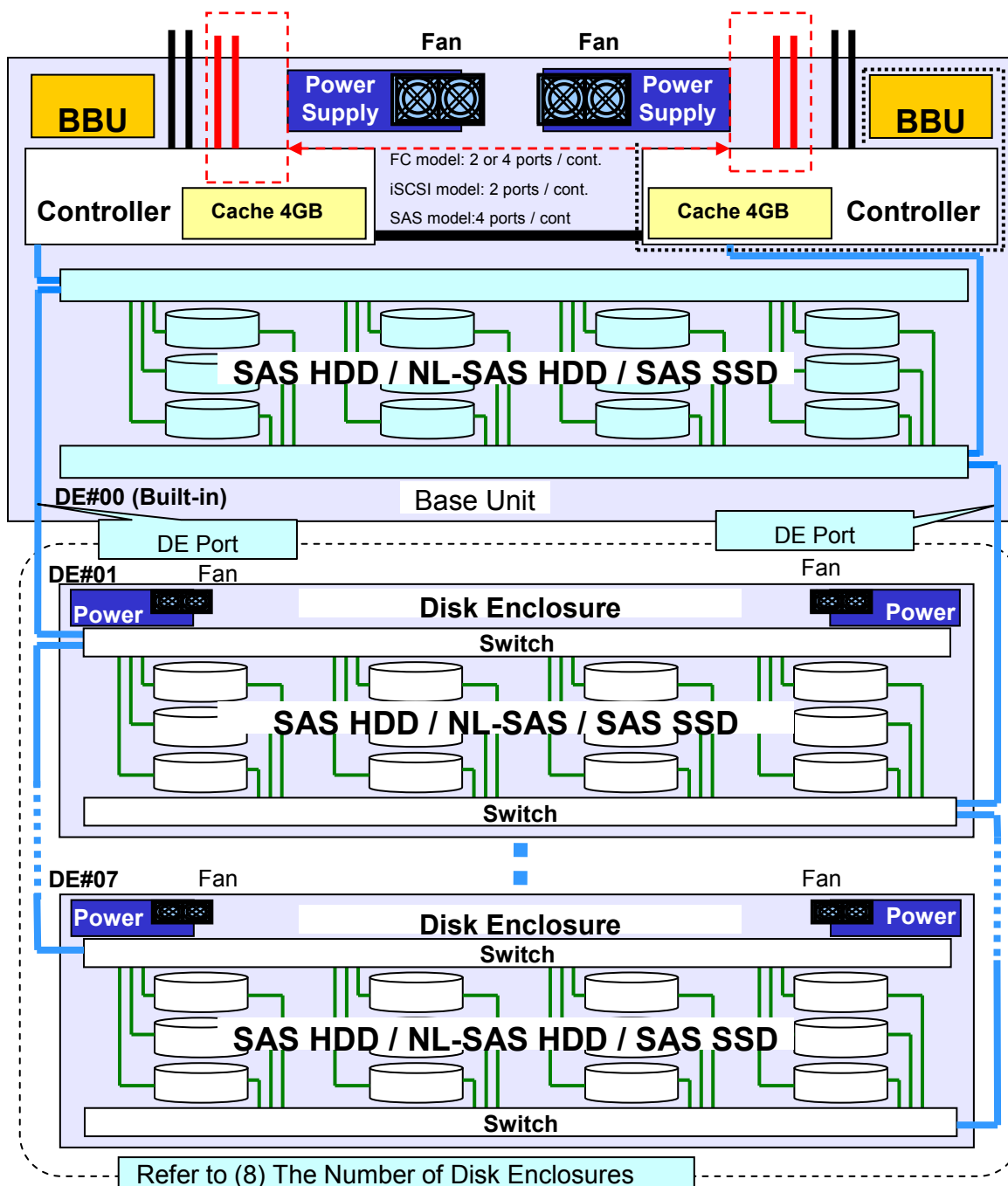
M100 Component Selection

2. M100 Component Selection (1)

■ Structure

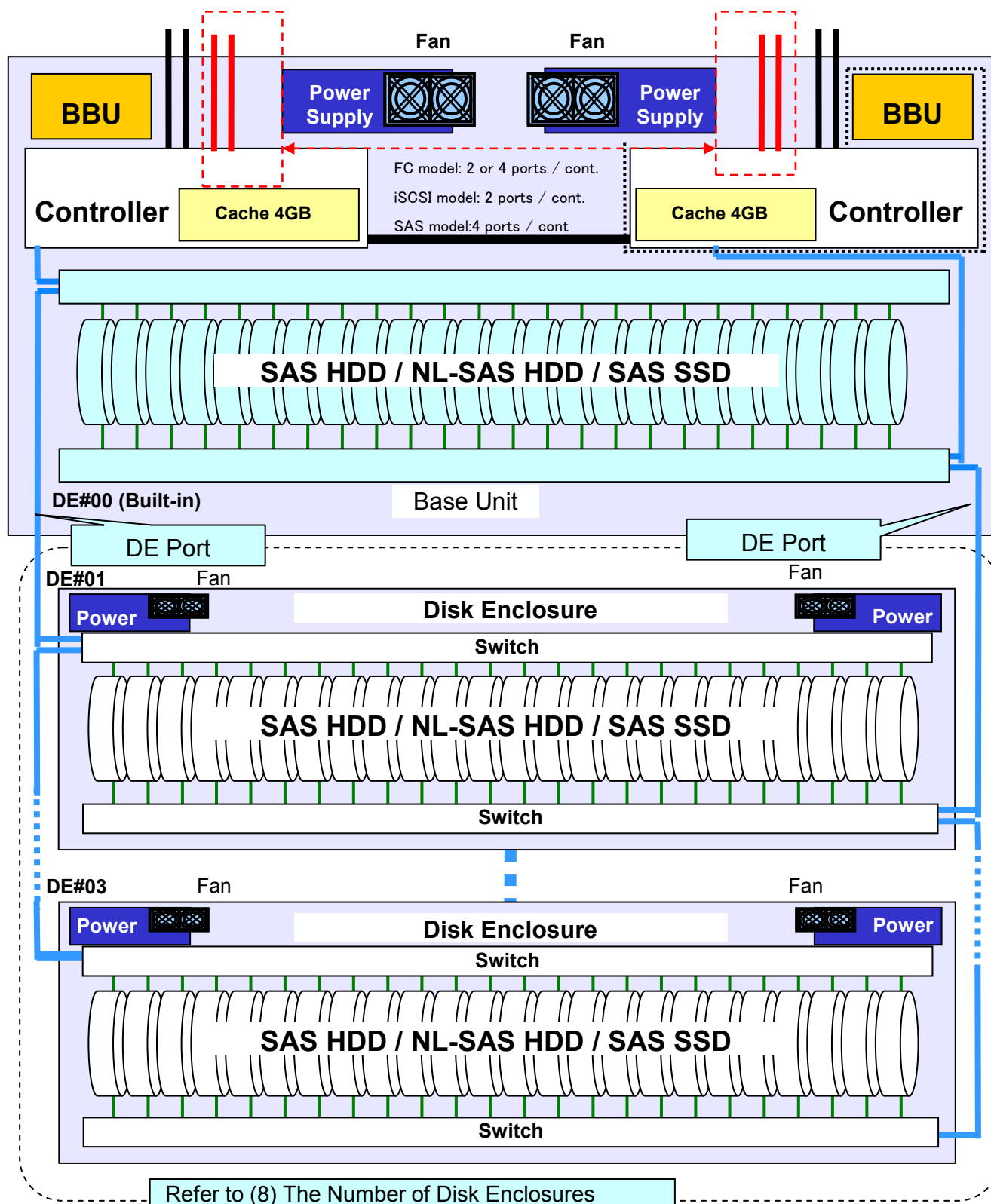
M100 Disk Array is a compact and entry level disk storage system in NEC Storage M-Series. The host interface has **four** models: 8Gb FC, 1Gb iSCSI, 10Gb iSCSI, **6Gb SAS**. M100 base units support 12x 3.5" drives and 24x 2.5" drives per 2U chassis. Disk enclosures can include a mix of SAS disk drives and Nearline SAS disk drives. Disk drives can be added to the maximum 96 disk drives by connecting disk enclosures.

■ Overview : M100 Disk Array (3.5")



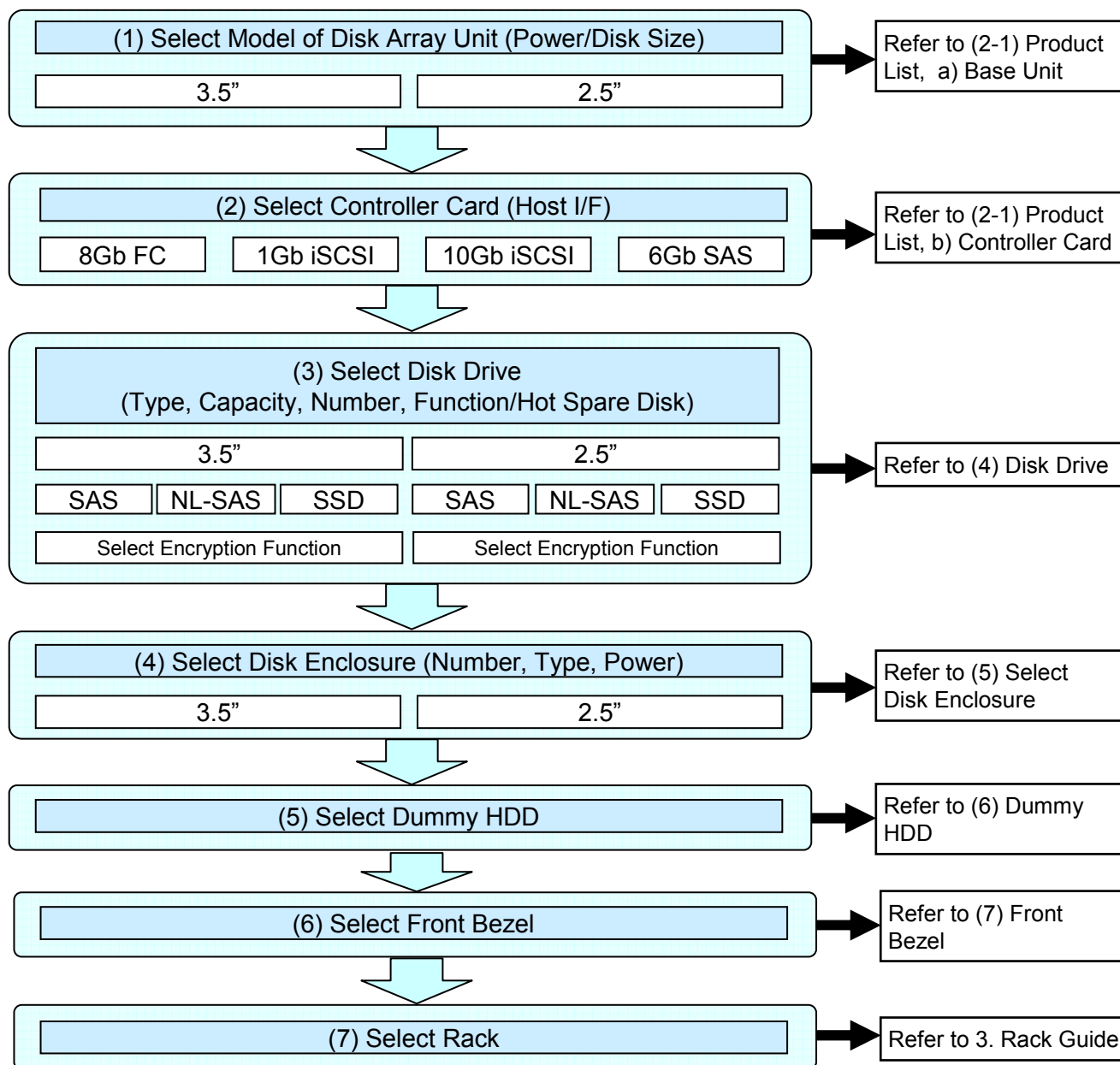
2. M100 Component Selection (2)

■ Overview : M100 Disk Array (2.5")

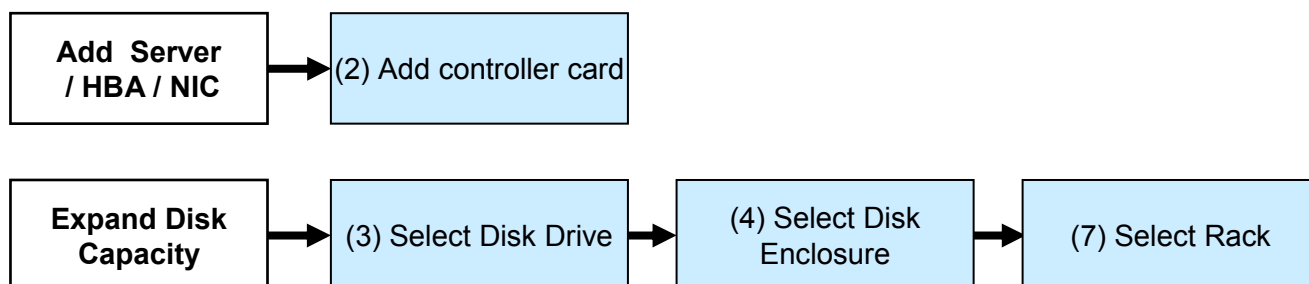


2. M100 Component Selection (3)

■ Steps for Component Selection When Purchasing a New System



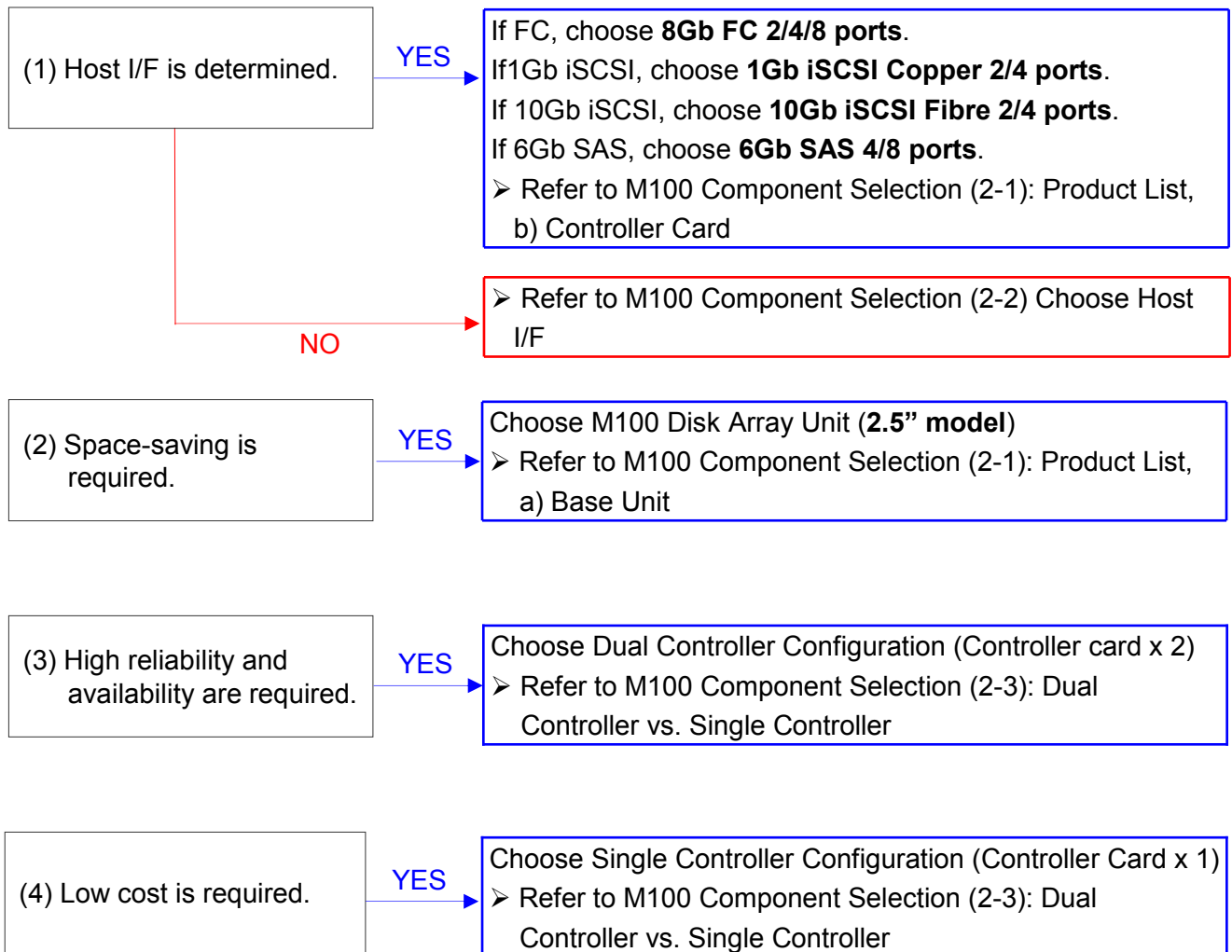
■ Steps for Expansion



2. M100 Component Selection (4)

(1) System Requirement and Recommended Product

An M100 Disk Array Unit does not include disk drives. A controller unit is not included with a base unit. Both the array controller unit and a controller card are required. The following steps and lists are references for choosing an appropriate product combination.



2. M100 Component Selection (5)

(2) Disk Array Unit Model

(2-1) Product List

a) Base Unit

Model Number	Product Name	Remarks	Accessories *1
NF5321-SB00E	M100 Disk Array Unit (3.5")	<ul style="list-style-type: none"> Power supply unit AC 100-240V 12 x 3.5" disk drives 	<ul style="list-style-type: none"> NEC Storage Rack Mount Kit List of accessories Ear Bezels *2 (left and right) HW Document CD (User Guide, Setup Guide, Installation Guide) NEC Storage PathManager (CD)
NF5321-SB01E	M100 Disk Array Unit (2.5")	<ul style="list-style-type: none"> Power supply unit AC 100-240V 24 x 2.5" disk drives 	

b) Controller Card (two cards for dual /one card for single controller configuration*3, *4)

Model Number	Product Name	Accessories
NF5321-SF01E	Controller Card (8Gb FC 2Port)	<ul style="list-style-type: none"> List of accessories NEC StorageManager (embedded)
NF5321-SF02E	Controller Card (8Gb FC 4Port)	
NF5321-SF11E	Controller Card (1Gb iSCSI Copper 2Port)	
NF5321-SF21E	Controller Card (10Gb iSCSI Fibre 2Port)	
NF5321-SF42E	Controller Card (6Gb SAS 4Port)	

*1 No front bezel is attached in M-Series Disk Array Units. If necessary, purchase it separately.

*2 Ear bezels indicate the black cover panels at both ends of base unit.



*3 No support on snapshot, data replication and cluster functions in Single Controller Configuration.

Refer to the next page "Dual Controller vs. Single Controller" for more details.

*4 Controller cards with different model numbers cannot be in the same chassis.

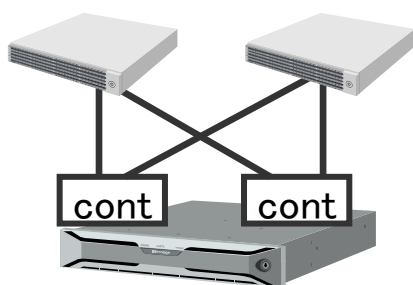
2. M100 Component Selection (6)

(2-2) Choose Host I/F

- 8Gb FC: High speed interface
- 1Gb iSCSI: Low cost and easy connection interface
- 10Gb iSCSI: High speed and easy connection interface
- 6GB SAS: Low cost DAS interface

(2-3) Dual Controller vs. Single Controller

Dual Controller Configuration (Standard Model)



◆ Characteristics

• Pros

- High Functionality/High Availability
- Data Protection
- Online FW update

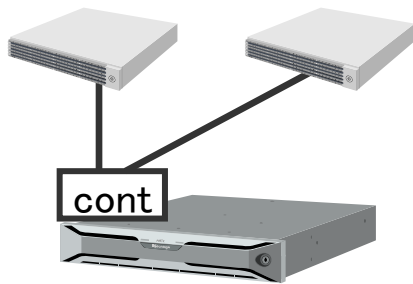
• Cons

- Higher cost than single controller configuration

◆ Usage

System which runs 24 hours a day, every day
(e.g.) System that provides services to users such as database and groupware operation, etc.

Single Controller Configuration (Low Cost Model)



◆ Characteristics

• Pros

- Lower cost than dual controller configuration

• Cons

- No support on cluster/ft server
- No snapshot/data replication
- No online FW upgrade

◆ Usage

System with the backup data on storage unit
(e.g.) System which has a backup server connected with a storage unit (single controller) as the primary backup and a tape drive as the secondary backup.

Notes: Single Controller Configuration

- 1) There is a case where the system crashes when a controller fails and although it is extremely rare, data integrity cannot be guaranteed. To maintain higher reliability, a dual controller configuration (standard model) is recommended.
- 2) When writing at high speeds to disk in Write-Cache mode, data may be lost due to troubles such as unexpected power shutdown or failure.

2. M100 Component Selection (7)

(3) NEC StorageManager Suite

NEC StorageManager Express is embedded in storage M100. This software can manage an M100 with basic functionalities and no management server is necessary. When more functions are required such as data replication, purchase NEC StorageManager Suite that requires a management server. Refer to the table below for functions which are available with NEC StorageManager Suite.

NEC StorageManager Suite specific functions [] designates optional product packages which can be purchased with NEC StorageManager Suite.	Supported Storage
	M100
Monitor multiple storages	○
Linkage with ESMPRO	○
Linkage with SigmaSystemCenter	○
Event Link (Report by e-mail. Run executable)	○
Monitor performance [NEC Storage PerformanceMonitor]	○
Analyze performance [NEC Storage PerformanceNavigator]	○
Alert (Express Alert, cooperate with syslog)	○
In-box replication [NEC Storage DynamicDataReplication]	○
Inter-box replication [NEC Storage RemoteDataReplication]	○ ^{*1}
Prevent unauthorized access or modification of data [NEC Storage VolumeProtect]	○

^{*1} Only FC host I/F is supported.

^{*2} Isolated Volume is scheduled to be supported in October 2011. Full function is scheduled to be supported in December 2011.

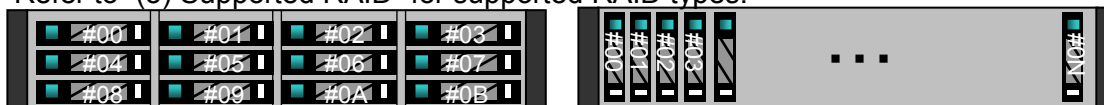
2. M100 Component Selection (8)

(4) Disk Drive

When deciding how many disk drives are required, remember that logical disk capacity varies depending on disk drive type (I/F, capacity) and RAID type. The number of disk drives is dependent on the amount of logical disk capacity that is required. The amount of required logical disk capacity varies depending on the amount of data usage and whether or not features (Snapshot, Replication) are required. Using required logical disk capacity and performance that is required, decide the number of disk drives, taking into account the disk drive type (I/F, capacity, rotation speed) and RAID type.

At least **three disk drives** have to be populated with **any disk drive types (SAS/Nearline SAS/SAS SSD)**

Refer to “(5) Supported RAID” for supported RAID types.



Slots #00, #01, and #02 must be populated.

(4-1) Disk Capacity

(Considerations for System Volume)

A system volume, in which performance logs, etc. are automatically saved, is created in the first binding Pool. System volume capacity is 8.0 GB. (or 8.6GB if 1KB = 1000Byte)

(Considerations for Snapshot)

When using the snapshot feature, it is necessary to create a snapshot reservation area for replication of a master volume (snapshot).

(Considerations for Replication)

When implementing the replication feature, use the storage system information retention function* and create a replication reserved volume with the NEC StorageManager application. The capacity of a replication reserved volume is 8.0GB. (or 8.6GB if 1KB = 1000Byte)

When turning power off via a planned shutdown all storage system information (differential map, etc) will be backed up onto the replication reserved volume only if it was configured. If the replication reserved volume is not configured then storage system information will be lost on shutdown. When restarting after a planned shutdown, I/O load will be generated as data on the MV is fully copied to the RV. This startup load may be large enough to temporarily affect performance. It is recommended to operate 24 hours nonstop, especially if running without a replication reserved volume.

* Storage system information retention function is used to backup storage system information such as the differential map between business volume (MV) and replication volume (RV) onto disk drives.

2. M100 Component Selection (9)

(4-2) Disk Drive Type

Select a disk drive type from the following table and decide how many drives are needed. (SSD: Max. of 12 drives supported)

Product Number	Product Name
NF5321-SM725E	SAS Disk Drive(3.5" 15krpm/300GB 6Gbps)
NF5321-SM727E	SAS Disk Drive(3.5" 15krpm/450GB 6Gbps)
NF5321-SM728E	SAS Disk Drive(3.5" 15krpm/600GB 6Gbps)
NF5321-SM728SDE	SAS Disk Drive(3.5" 15krpm/600GB 6Gbps Self-encrypting)
NF5321-SM775E	SAS Disk Drive(2.5" 15krpm/300GB 6Gbps)
NF5321-SM765E	SAS Disk Drive(2.5" 10krpm/300GB 6Gbps)
NF5321-SM767E	SAS Disk Drive(2.5" 10krpm/450GB 6Gbps)
NF5321-SM768E	SAS Disk Drive(2.5" 10krpm/600GB 6Gbps)
NF5321-SM768SDE	SAS Disk Drive(2.5" 10krpm/600GB 6Gbps Self-encrypting)
NF5321-SM706E	NearlineSAS Disk Drive(3.5" 7.2krpm/1TB 6Gbps)
NF5321-SM708E	NearlineSAS Disk Drive(3.5" 7.2krpm/2TB 6Gbps)
NF5321-SM756E	NearlineSAS Disk Drive(2.5" 7.2krpm/1TB 6Gbps)
NF5321-SS7E6E	SAS SSD Drive(3.5" 400GB 6Gbps)
NF5321-SS784E	SAS SSD Drive(2.5" 100GB 6Gbps)

2. M100 Component Selection (10)

(4-3) Disk Drive Usage

Both base unit and SAS disk enclosures can include a mix of SAS/Nearline SAS/SAS SSD disk drives and disk drives with different capacities and rotation speeds.

A pool must contain disk drives with the same interface. The capacity or rotation speed does not matter. However, it is strongly recommended to have the same capacity and the same rotation speed in the same pool. When having different capacities of disk drive in a pool, the pool will be created based on the disk drive with the smallest capacity. In this case, the differences between larger disk drives and the smallest disk drives are not used. Note that SAS and Nearline SAS are different interfaces.

<Example>

A pool configured by SAS disk drives (15krpm/300GB) and SAS disk drives (15krpm/600GB)

- The SAS disk drive (15krpm/600GB) is treated as a SAS disk drive (15krpm/300GB).

When using different speeds of disk drives in a pool, the pool will be created based on the slowest disk speed. In this case, performance will not be as good as expected because drives with faster speed are treated the same as drives with the slowest speed.

<Example>

A pool configured by 3.5" SAS disk drives (15krpm/300GB) and 2.5" SAS disk drive(10krpm/300GB)

- The SAS disk drive (15krpm/300GB) is treated as a SAS disk drive (10krpm/300GB).

(4-4) Supported RAID

NEC Storage M-Series supports the following RAID types. (Note: Only RAID-1, 10, 5(4+P), 50(4+P) are supported with SSD)

RAID Type	Configuration	Number of physical disk drives	Redundancy	RAID Capacity
RAID-0		*	None	Physical disk capacity x 1
RAID-1/10	(1+1) x n	2 or more disk drives	1	Physical disk capacity x 1/2
RAID-5/50	(2+P) x n	3 or more disk drives	1	Physical disk capacity x 2/3
	(4+P) x n	5 or more disk drives	1	Physical disk capacity x 4/5
	(8+P) x n	9 or more disk drives	1	Physical disk capacity x 8/9
RAID-6/60	(4+PQ) x n	6 or more disk drives	2	Physical disk capacity x 2/3
	(8+PQ) x n	10 or more disk drives	2	Physical disk capacity x 4/5
RAID-TM	(1+1+1) x n	3 or more disk drives	2	Physical disk capacity x 1/3

* RAID-0: Data is not protected.

(4-5) Dynamic Pool

NEC Storage M-Series supports only dynamic pools. LUN capacity can be modified dynamically. Capacity is constant regardless of the number of disk drives. It is slightly less than the table on the previous page. Striping is automatic when an applicable number of disk drives are used with RAID types that support striping.

Example: RAID-1 with 4 disk drives is automatically configured as RAID-10.

Refer to "5. Functions <Pool>" for more details about Dynamic Pool.

2. M100 Component Selection (11)

(4-6) Hot Spare Disk

When assigning hot spare disks:

- Assigning a hot spare disk enables automatic restoration of data without waiting for a maintenance service agent in the event of disk failure. Data redundancy is recovered when restoring the data to the hot spare.
- M-Series has a "Preventive maintenance function" that moves data to hot spare disks before a disk failure occurs by detecting symptoms of the failure in order to maintain redundancy.
- It is strongly recommended to assign a hot spare disk in order to enhance the availability of disk array units.
- M-Series has a global hot spare function which enables hot spare disks to be used with any HDD/SSD.
- SSD hot spare is only good with SSDs. SSD cannot be used as a hot spare with HDDs. Likewise, HDD cannot be used as a hot spare with SSDs.
- When multiple types of disk drives are defined as hot spare disks, the priority is as follows.
 - 1.The same interface, the same capacity and the same rotation speed as the base disk drive*.
 - 2.The same interface, the same capacity as the base disk drive* but the slower disk used first when multiple speeds of hot spare drives exist.
 - 3.The same interface as the base disk drive*, but larger than the base disk drive*. When multiple sizes of hot spare disks exist, the smaller disk is used first.
- * Base disk drive = disk drive with the smallest capacity/slowest rotation speed in the pool.
- The number of recommended hot spares varies depending on the disk drive type. Refer to the table below.

Disk drive type	Condition	Recommendation
SAS Disk Drive	One type of capacity/rotation speed	One hot spare drive / 24 disk drives
	n types of capacity/rotation speed	n spare disk drives / 24 disk drives
Nearline SAS Disk Drive *1	One type of capacity/rotation speed	One hot spare drive / 12 disk drives
	n types of capacity/rotation speed	n spare disk drives / 12 disk drives
SAS SSD	Hot spare is optional. Because SAS SSD does not have mechanical parts such as motors, heads and media, it is reliable. Assign hot spare disks as a customer requests.	

*1 Must assign hot spare disks when Nearline SAS disk drives are in the system.

<Example>

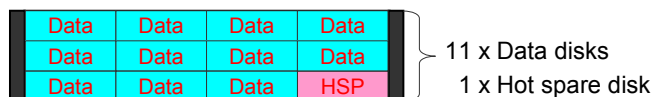
SAS disk drives



Data: Data disk

HSP: Hot spare disk

Nearline SAS disk drives



Refer to "5. Functions <Hot Spare Disk>" for more details about hot spare disks.

2. M100 Component Selection (12)

(5) Select Disk Enclosure

(5-1) The Number of Disk Enclosures

Select a disk enclosure below when more disk drives are needed than the base unit has (3.5": 12, 2.5": 24) or when disk drives that are different from ones in the base unit are required.

Model number	Model name	Max. num of disk drives	Power supply	Accessories
NF5321-SE70E	Disk Enclosure (3.5", 6Gpbs)	12	AC100V - 240V	SAS cable (1m) x 2 Ear Bezel x 2
NF5321-SE71E	Disk Enclosure (2.5", 6Gpbs)	24	AC100V - 240V	NEC Storage Rack Mount Kit x 1 List of accessories x 1

When the base unit and one or more disk enclosures will be in different racks, a SAS cable (1m) will not be long enough and the SAS cable (5m) in the table below will be needed.

Model Number	Product Name	Cable Length	Remarks
NF9120-SJ54	SAS Cable (5m)	5m	2 x SAS cables (DAC-DE / DE-DE) (for one disk enclosure)

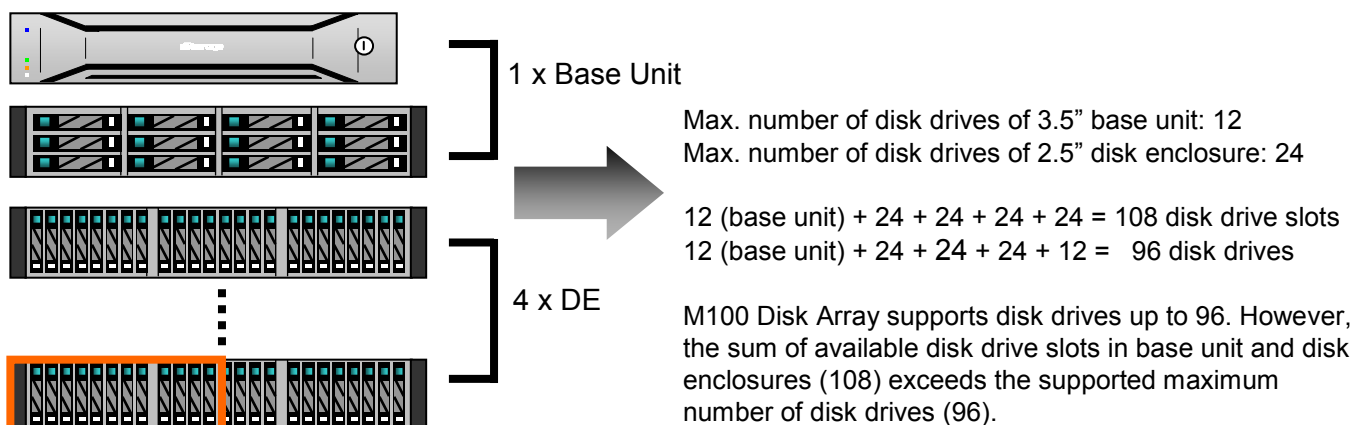
【CAUTION: The Number of Disk Enclosures】

M-Series can use a mix of 3.5" and 2.5" disk enclosures at the same time.

The sum of available disk drive slots in both base unit and disk enclosures must not exceed the supported maximum number of disk drives. Note: Even if a disk drive slot is not populated, it is still counted.

For example:

I would like to use 96 disk drives in base unit (3.5") and four disk enclosures (2.5").
 1 x 3.5" base unit: 12 disk drives in base unit
 4 x 2.5" disk enclosures: 24 disk drives in three disk enclosures. 12 disk drives in one disk enclosure.
 Is this supported? → **No, it is not supported.**



→ **This configuration is not supported.**

2. M100 Component Selection (13)

(5-2) The table of the sum of disk drive slots

As described in the section “The number of disk enclosures”, M-Series can use a mix of 3.5” and 2.5” disk enclosures at the same time. Confirm disk enclosure/disk drive configuration using the following tables.

Base Unit	Num of 3.5" DE	Num of 2.5" DE	Sum of slots	Sum of DE
M100 DAC (3.5")	0	0	12	0
	1	0	24	1
	2	0	36	2
	3	0	48	3
	4	0	60	4
	5	0	72	5
	6	0	84	6
	7	0	96	7
	0	1	36	1
	1	1	48	2
	2	1	60	3
	3	1	72	4
	4	1	84	5
	5	1	96	6
	0	2	60	2
	1	2	72	3
	2	2	84	4
	3	2	96	5
	0	3	84	3
	1	3	96	4

Base Unit	Num of 3.5" DE	Num of 2.5" DE	Sum of slots	Sum of DE
M100 DAC (2.5")	0	0	24	0
	1	0	36	1
	2	0	48	2
	3	0	60	3
	4	0	72	4
	5	0	84	5
	6	0	96	6
	0	1	48	1
	1	1	60	2
	2	1	72	3
	3	1	84	4
	4	1	96	5
	0	2	72	2
	1	2	84	3
	2	2	96	4
	0	3	96	3

【Basics】

3.5" DAC: 12 disk drive slots

2.5" DAC: 24 disk drive slots

3.5" DE: 12 disk drive slots

2.5" DE: 24 disk drive slots

<Example>

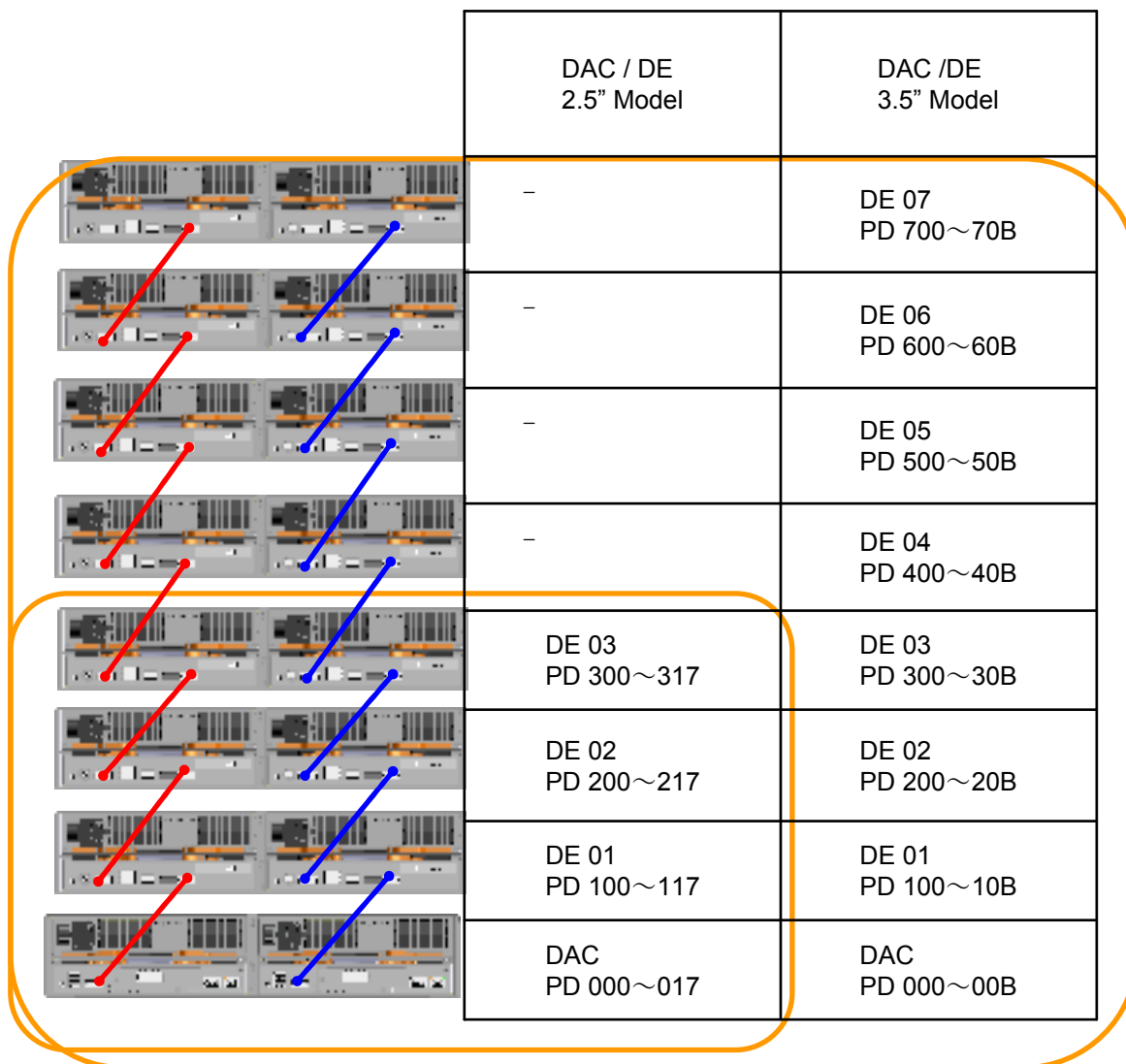
3.5" DAC + 3.5" DE + 2.5" DE = 12 + 12 + 24 = 48

The sum of disk driver slots is 48.

2. M100 Component Selection (14)

(5-3) DE Connection

The Disk Array Unit can be connected up to the maximum number of DE shown below. DE starts from “01” because functionality equivalent to “DE 00” is built into DAC. The figure below shows how to connect DEs and the DE numbers and PD numbers.



2. M100 Component Selection (15)

(6) Dummy HDD


It is required to include a dummy HDD in a empty slot of a base unit or a disk enclosure. No dummy HDD is not included with a base unit nor disk enclosure. Purchase the required number of dummy HDD separately.

Model Number	Product Name	Accessories
NF9100-CZ25	Dummy HDD Tray (3.5") x 1	• List of accessories
NF9100-CZ29	Dummy HDD Tray (2.5") x 1	• List of accessories

2. M100 Component Selection (16)

(7) Front Bezel

No front bezel is included with the M-Series Disk Array Unit (both base unit and disk enclosure). If desired, purchase it separately.

Model number	Product name	Figure	Remarks
NF9100-SF12	Front Bezel		Key (2)

(8) Management LAN Port

M100 are equipped with two LAN ports per Disk Array Unit. (M100 can be configured for single controller configuration. In this case, one LAN port.) Management LAN port supports the following:

- 10BASE-T/100BASE-T/1000BASE-T (Auto-negotiation)
- SNMP protocol (Version 1/2c/3)
- NEC StorageManager
- CLI commands via Telnet/SSH
- Network connector RJ-45
- Floating IP

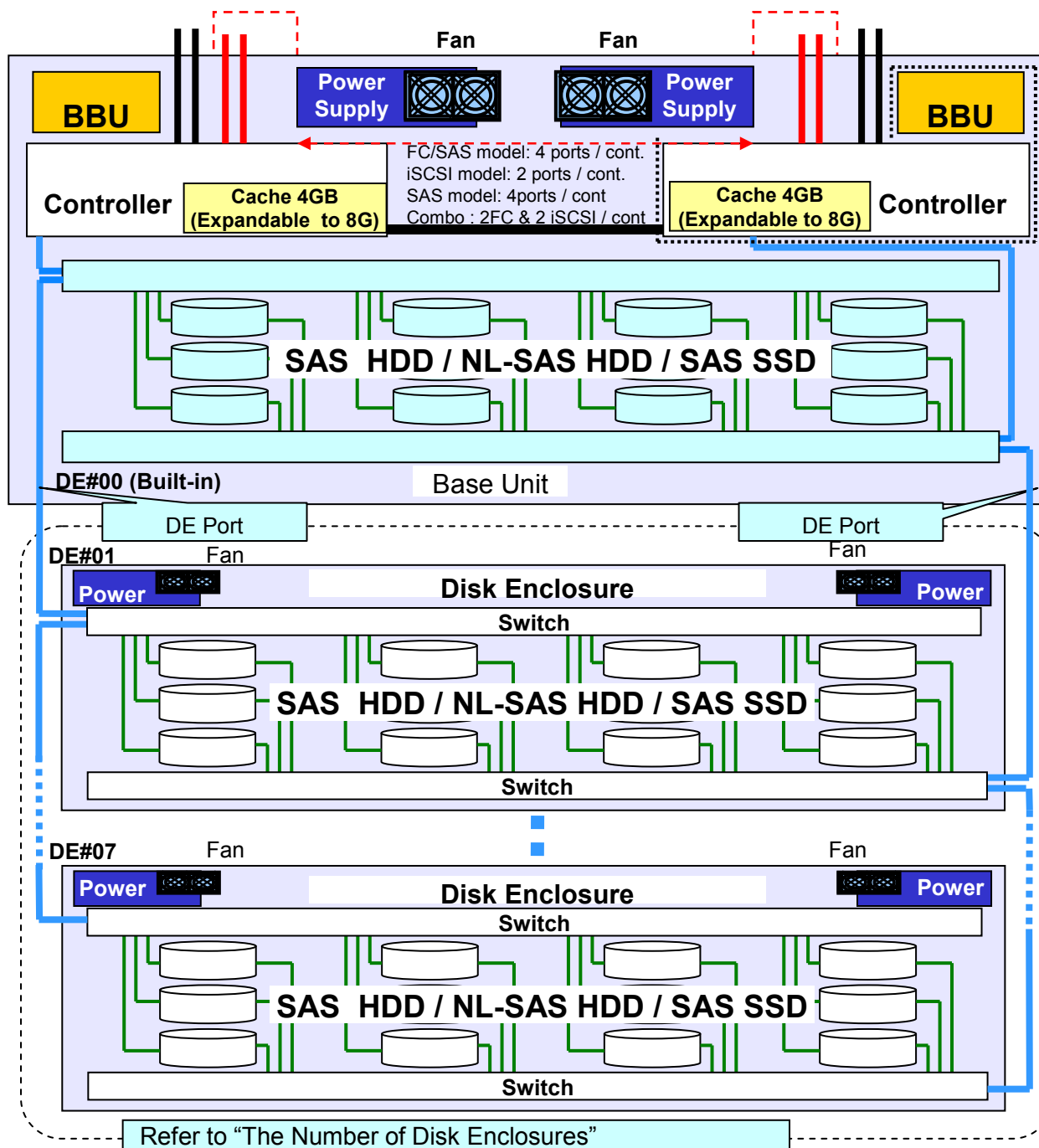
M300 Component Selection

2. M300 Component Selection (1)

■ Structure

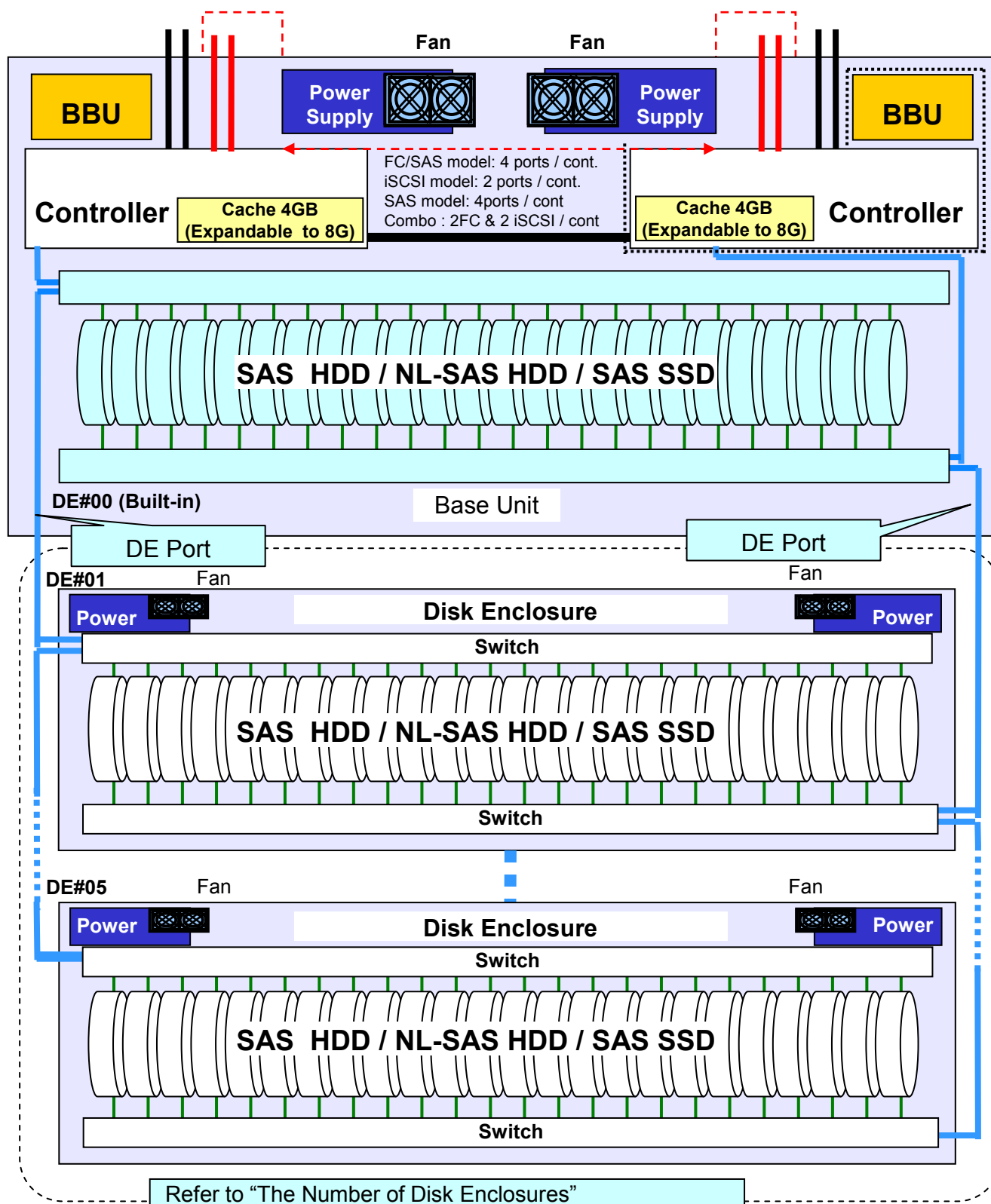
M300 is a compact and low-end disk storage system in NEC Storage M-Series. There are five models available: 8Gb FC, 1Gb iSCSI, 10Gb iSCSI, 6Gb SAS and mixed model supports both 8Gb FC and 1Gb iSCSI topologies. The units support 12x 3.5" drives and 24x 2.5" drives per 2U chassis. M300 can include a mix of SAS disk drives and Nearline SAS disk drives. Disk drives can be added to the maximum 96x 3.5" disk drives and 144x 2.5" disk drives by connecting disk enclosures.

■ Overview: M300 Disk Array (3.5)



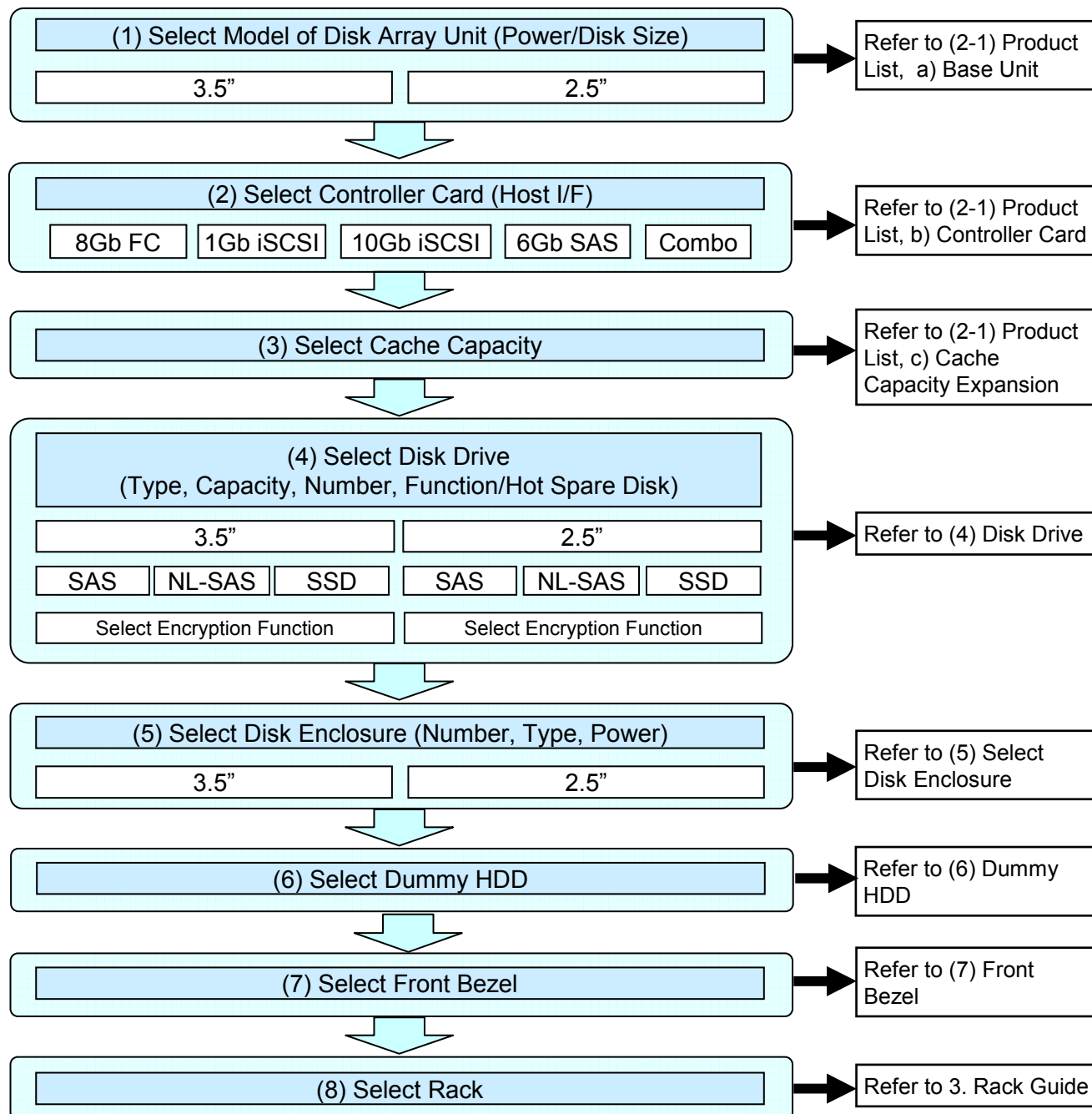
2. M300 Component Selection (2)

■ Overview : M300 Disk Array (2.5")

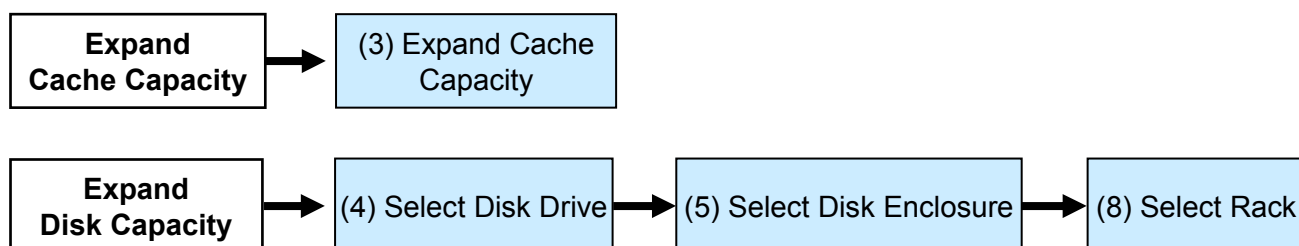


2. M300 Component Selection (3)

■ Steps for Component Selection When Purchasing a New System



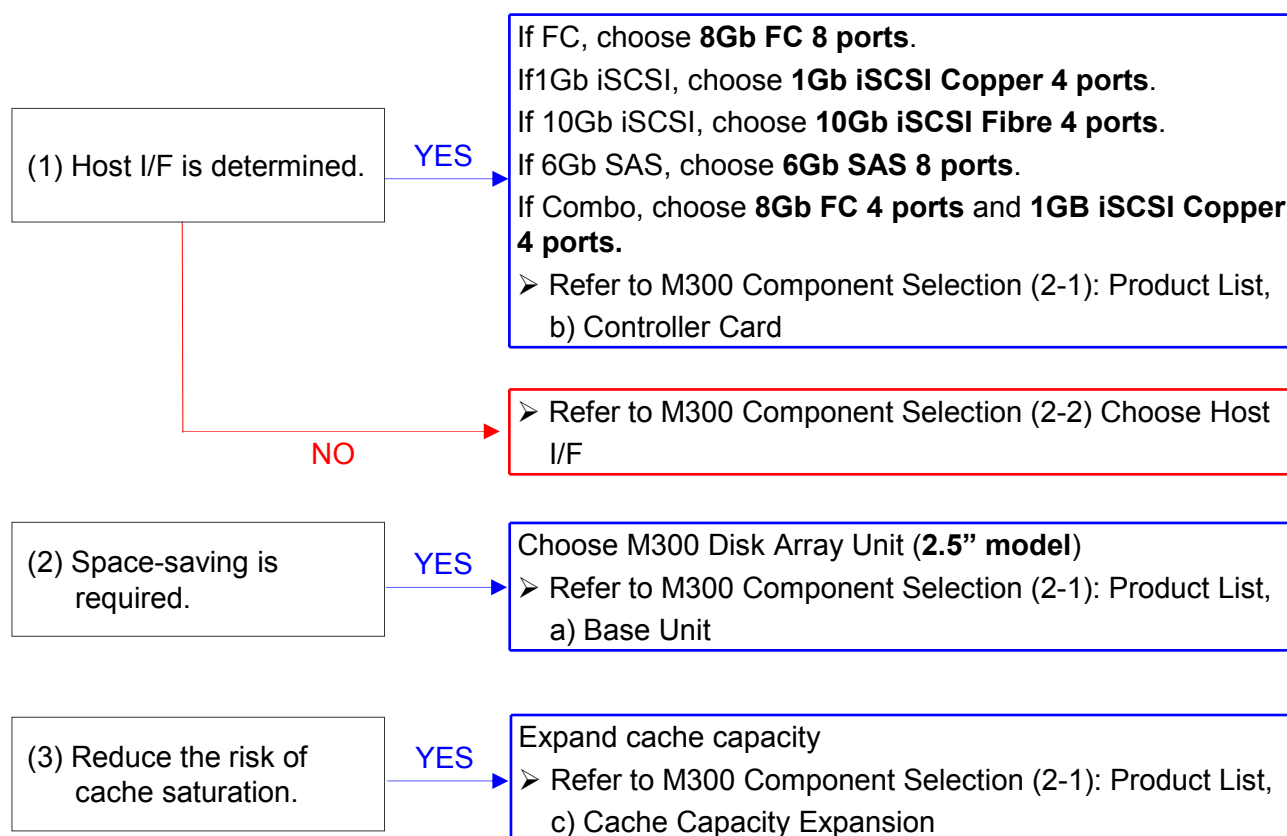
■ Steps for Expansion



2. M300 Component Selection (4)

(1) System Requirement and Recommended Product

An M300 Disk Array Unit does not include disk drives. A controller unit is not included with a base unit. Both the array controller unit and a controller card are required. The following steps and lists are references for choosing an appropriate product combination.



2. M300 Component Selection (5)

(2) Disk Array Unit Model

(2-1) Product List

a) Base Unit

Model Number	Product Name	Remarks	Accessories ^{*1}
NF5331-SB00E	M300 Disk Array Unit (3.5")	<ul style="list-style-type: none"> Power supply unit AC 100-240V 3.5" disk drives 	<ul style="list-style-type: none"> NEC Storage Rack Mount Kit List of accessories Ear Bezels ^{*2} (left and right) HW Document CD (User Guide, Setup Guide, Installation Guide) NEC Storage PathManager (CD)
NF5331-SB01E	M300 Disk Array Unit (2.5")	<ul style="list-style-type: none"> Power supply unit AC 100-240V 2.5" disk drives 	

b) Controller Card

Model Number	Product Name	Accessories
NF5331-SF02WE	Controller Card x 2 (8Gb FC 4Port x 2)	• List of accessories
NF5331-SF11WE	Controller Card x 2 (1Gb iSCSI Copper 2Port x 2)	
NF5331-SF21WE	Controller Card x 2 (10Gb iSCSI Fiber 2Port x 2)	
NF5331-SF42WE	Controller Card x 2 (6GB SAS 4Port x 2)	
NF5331-SF81WE	Controller Card x 2 [(8Gb FC 2Port + 1GB iSCSI 2 Port) x 2]	

^{*1} No front bezel is attached on M-Series Disk Array Units. Purchase the bezel separately if required.

^{*2} Ear bezels indicate the black cover panels at both ends of base unit.

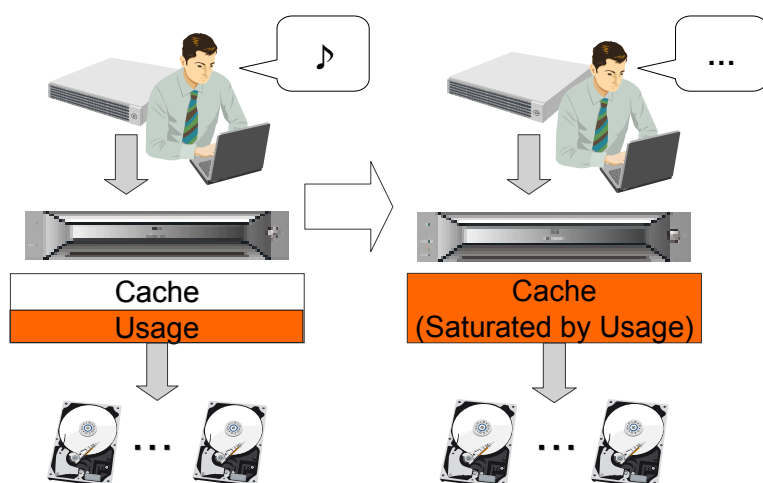


2. M300 Component Selection (6)

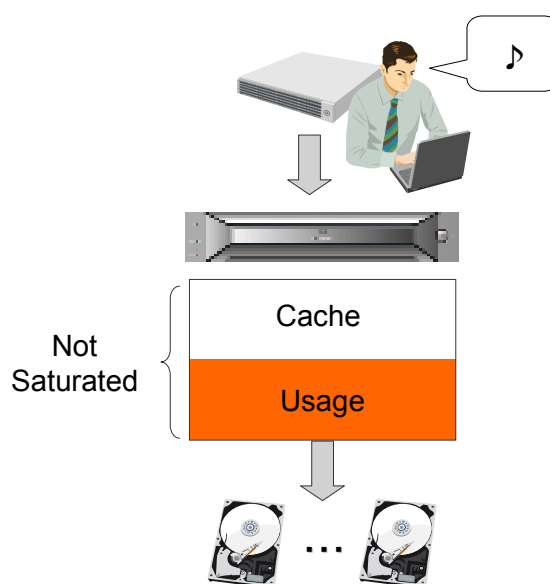
c) Cache Capacity Expansion

Cache memory is included, with 8GB standard per unit. By expanding cache to 16GB, the performance of the disk array unit can be improved. Cache memory can provide better performance by improving access times to frequently accessed data and significantly can improve on write performance. In order to reduce the occurrence of cache overflow conditions in high performance environments, it is recommended to expand cache to maximum (16GB).

(1) Cache Saturation



(2) Cache Expansion



Expansion Cache Model

Model Name	Product Name	Remarks
NF5331-SC01E	Expandable cache module (8GB to 16GB)	Cache memory capacity per unit can be expanded from 8GB to 16GB.

(2-2) Choose Host I/F

- 8Gb FC: High speed interface
- 1Gb iSCSI: Low cost and easy connection interface
- 10Gb iSCSI: High speed and easy connection interface
- 6GB SAS: Low cost DAS interface

2. M300 Component Selection (7)

(3) NEC StorageManager

NEC StorageManager software performs basic and advanced storage management functions. It is a base product that manage multiple arrays from a single point. It requires a management server.

Refer to the table below for functions which are available with NEC StorageManager.

NEC StorageManager functions	Supported Storage
	M300
Monitor multiple storages	○
Linkage with ESMPRO	○
Linkage with SigmaSystemCenter	○
Event Link (Report by e-mail. Run executable)	○
Monitor performance [NEC Storage PerformanceMonitor]	○
Analyze performance [NEC Storage PerformanceNavigator]	○
Alert (Express Alert, cooperate with syslog)	○
In-box replication [NEC Storage DynamicDataReplication]	○
Inter-box replication [NEC Storage RemoteDataReplication]	○ ^{*1}
Prevent unauthorized access or modification of data [NEC Storage VolumeProtect]	○

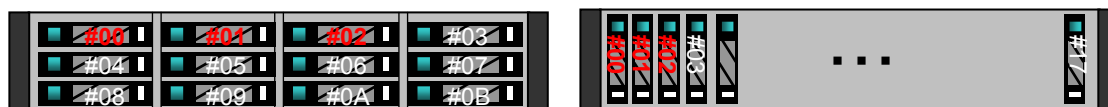
^{*1} Only FC host I/F is supported.

2. M300 Component Selection (8)

(4) Disk Drive

When deciding how many disk drives are required, remember that logical disk capacity varies depending on both disk drive type (I/F, capacity) and RAID type. The amount of required logical disk capacity varies depending on the amount of data usage and whether or not specific features (Snapshot, Replication) are required. Using estimated logical disk capacity and desired performance, the number of disk drives can be estimated. Include all relevant topology factors (I/F, capacity, rotation speed, RAID type) when calculating capacity. A minimum of **three disk drives** is required.

Refer to “(4-4) Supported RAID” for supported RAID types.



Slots #00, #01, and #02 must be populated.

(4-1) Disk Capacity

(Considerations for System Volume)

A system volume, in which performance logs, etc. are automatically saved, is created in the first binding Pool. System volume capacity is 8.0 GB. (or 8.6GB if 1KB = 1000Byte)

(Considerations for Snapshot)

When using the snapshot feature, it is necessary to create a snapshot reservation area for replication of a master volume (snapshot).

(Considerations for Replication)

When implementing the replication feature, use the storage system information retention function* and create a replication reserved volume with the NEC StorageManager application. The capacity of a replication reserved volume is 8.0GB. (or 8.6GB if 1KB = 1000Byte)

When turning power off via a planned shutdown all storage system information (differential map, etc) will be backed up onto the replication reserved volume only if it was configured. If the replication reserved volume is not configured then storage system information will be lost on shutdown. When restarting after a planned shutdown, I/O load will be generated as data on the MV is fully copied to the RV. This startup load may be large enough to temporarily affect performance. It is recommended to operate 24 hours nonstop, especially if running without a replication reserved volume.

* Storage system information retention function is used to backup storage system information such as the differential map between business volume (MV) and replication volume (RV) onto disk drives.

2. M300 Component Selection (9)

(4-2) Disk Drive Type

Select a disk drive type from the following table and decide how many drives are needed. (SSD: Maximum of 12 drives supported.)

Product Number	Product Name
NF5321-SM725E	SAS Disk Drive(3.5" 15krpm/300GB 6Gbps)
NF5321-SM727E	SAS Disk Drive(3.5" 15krpm/450GB 6Gbps)
NF5321-SM728E	SAS Disk Drive(3.5" 15krpm/600GB 6Gbps)
NF5321-SM728SDE	SAS Disk Drive(3.5" 15krpm/600GB 6Gbps Self-encrypting)
NF5321-SM775E	SAS Disk Drive(2.5" 15krpm/300GB 6Gbps)
NF5321-SM765E	SAS Disk Drive(2.5" 10krpm/300GB 6Gbps)
NF5321-SM767E	SAS Disk Drive(2.5" 10krpm/450GB 6Gbps)
NF5321-SM768E	SAS Disk Drive(2.5" 10krpm/600GB 6Gbps)
NF5321-SM768SDE	SAS Disk Drive(2.5" 10krpm/600GB 6Gbps Self-encrypting)
NF5321-SM706E	NearlineSAS Disk Drive(3.5" 7.2krpm/1TB 6Gbps)
NF5321-SM708E	NearlineSAS Disk Drive(3.5" 7.2krpm/2TB 6Gbps)
NF5321-SM756E	NearlineSAS Disk Drive(2.5" 7.2krpm/1TB 6Gbps)
NF5321-SS7E6E	SAS SSD Drive(3.5" 400GB 6Gbps)
NF5321-SS784E	SAS SSD Drive(2.5" 100GB 6Gbps)

2. M300 Component Selection (10)

(4-3) Disk Drive Usage

Both the base unit and SAS disk enclosures can include a mix of SAS disk drives/Nearline SAS disk drives/SAS SSD and disk drives with different capacities and rotation speeds.

A pool must contain disk drives with the same interface. The capacity or rotation speed does not matter. However, it is strongly recommended to use devices of the same capacity and same rotation speed in a pool. When using different capacities of disk drive in a pool, the pool will be created based on the disk drive with the smallest capacity. In this case, the differences between larger disk drives and the smallest disk drives are not used. Note that SAS and Nearline SAS are different interfaces.

<Example>

A pool configured by SAS disk drives (15krpm/300GB) and SAS disk drives (15krpm/600GB)

➤ The SAS disk drive (15krpm/600GB) is treated as a SAS disk drive (15krpm/300GB).

When using different speeds of disk drives in a pool, the pool will be created based on the slowest disk speed. In this case, performance will not be as good as expected because drives with faster speed are treated the same as drives with the slowest speed.

<Example>

A pool configured by 3.5" SAS disk drives (15krpm/300GB) and 2.5" SAS disk drive(10krpm/300GB)

➤ The SAS disk drive (15krpm/300GB) is treated as a SAS disk drive (10krpm/300GB).

(4-4) Supported RAID

NEC Storage M-Series supports the following RAID types. (Note: Only RAID-1, 10, 5(4+P), 50(4+P) are supported with SSD)

RAID Type	Configuration	Number of physical disk drives	Redundancy	RAID Capacity
RAID-0	*		None	Physical disk capacity x 1
RAID-1/10	(1+1) x n	2 or more disk drives	1	Physical disk capacity x 1/2
RAID-5/50	(2+P) x n	3 or more disk drives	1	Physical disk capacity x 2/3
	(4+P) x n	5 or more disk drives	1	Physical disk capacity x 4/5
	(8+P) x n	9 or more disk drives	1	Physical disk capacity x 8/9
RAID-6/60	(4+PQ) x n	6 or more disk drives	2	Physical disk capacity x 2/3
	(8+PQ) x n	10 or more disk drives	2	Physical disk capacity x 4/5
RAID-TM	(1+1+1) x n	3 or more disk drives	2	Physical disk capacity x 1/3

* RAID-0: Data is not protected.

(4-5) Dynamic Pool

NEC Storage M-Series supports only dynamic pools. LUN capacity can be modified dynamically. Capacity is constant regardless of the number of disk drives. It is slightly less than the table above. Striping is automatic when an applicable number of disk drives are used with RAID types that support it.

<Example> RAID-1 with 4 disk drives is automatically configured as RAID-10.

Refer to "5. Functions <Pool>" for more details about dynamic pool.

2. M300 Component Selection (11)

(4-6) Hot Spare Disk

When assigning hot spare disks:

- Assigning a hot spare disk enables automatic restoration of data without waiting for a maintenance service agent in the event of disk failure. Data redundancy is recovered when restoring the data to the hot spare.
- M-Series has a “Preventive maintenance function” that moves data to hot spare disks before a disk failure occurs by detecting symptoms of the failure in order to maintain redundancy.
- It is strongly recommended to assign a hot spare disk in order to enhance the availability of disk array units.
- M-Series has a global hot spare function which enables hot spare disks to be used with any HDD/SSD.
- SSD hot spare is only good with SSDs. SSD cannot be used as a hot spare with HDDs. Likewise, HDD cannot be used as a hot spare with SSDs.
- When multiple types of disk drives are defined as hot spare disks, the priority is as follows.
 1. The same interface, the same capacity and the same rotation speed as the base disk drive*.
 2. The same interface, the same capacity as the base disk drive* but the slower disk used first when multiple speeds of hot spare drives exist.
 3. The same interface as the base disk drive*, but larger than the base disk drive*. When multiple sizes of hot spare disks exist, the smaller disk is used first.
- * Base disk drive = disk drive with the smallest capacity/slowest rotation speed in the pool.
- The number of recommended hot spares varies depending on the disk drive type. Refer to the table below.

Disk drive type	Condition	Recommendation
SAS Disk Drive	One type of capacity/rotation speed	One hot spare drive / 24 disk drives
	n types of capacity/rotation speed	n spare disk drives / 24 disk drives
Nearline SAS Disk Drive *1	One type of capacity/rotation speed	One hot spare drive / 12 disk drives
	n types of capacity/rotation speed	n spare disk drives / 12 disk drives
SAS SSD	Hot spare is optional. Because SAS SSD does not have mechanical parts such as motors, heads and media, it is reliable. Assign hot spare disks as a customer requests.	

*1 Must assign hot spare disks when Nearline SAS disk drives are in the system.

<Example>

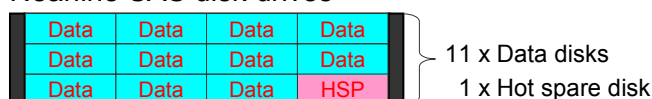
SAS disk drives



Data: Data disk

HSP: Hot spare disk

Nearline SAS disk drives



Refer to “5. Functions <Hot Spare Disk>” for more details about hot spare disks.

2. M300 Component Selection (12)

(5) Select Disk Enclosure

(5-1) The Number of Disk Enclosures

Select a new disk enclosure below when more disk drives are needed than the base unit or when disk drives that are different from ones in the base unit are required.

Model number	Model name	Max. num of disk drives	Power supply	Accessories
NF5321-SE70E	Disk Enclosure (3.5", 6Gpbs)	12	AC100V - 240V	SAS cable (1m) x 2 Ear Bezel x 2 NEC Storage Rack Mount Kit x 1
NF5321-SE71E	Disk Enclosure (2.5", 6Gpbs)	24	AC100V - 240V	List of accessories x 1

When the base unit and one or more disk enclosures will be in different racks, a SAS cable (1m) will not be long enough, necessitating the SAS cable (5m) in the table below.

Model number	Product name	Cable length	Remarks
NF9120-SJ54	SAS Cable (5m)	5m	2 x SAS cables (DAC-DE / DE-DE) (for one disk enclosure)

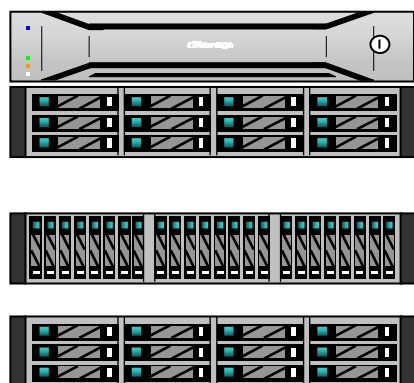
【CAUTION: The Number of Disk Enclosures】

M-Series can use a mix of 3.5" and 2.5" disk enclosures at the same time.

M300 supports up to 144 disk drives and up to 7 disk enclosures. Note that even if a disk drive slot is not populated, it is still counted. (M300 supports up to 144 disk drive slots.)

<Example 1> M300: The total number of disk enclosures exceeds the maximum supported number of disk enclosures

M300 supports up to 144 disk drives. I'd like to configure M300 with 132 disk drives.
 1 x 3.5" DAC + 6 x 3.5" DEs + 2 x 2.5" DEs
 12 disk drive slots in DAC + 72 disk drive slots in 3.5" DEs + 48 disk drive slots in 2.5" DEs = 12 + 72 + 48 = 132 disk drive slots. All slots are populated.
 Is this configuration supported? → **No, it is not supported.**



1 x DAC

6 x 3.5" Disk enclosures
2 x 2.5" Disk enclosures



This configuration has 8 disk enclosures that exceed 7, the max. disk enclosures supported by M300.

This configuration is not supported.

8 x DE

(6 x 3.5", 2 x 2.5")

2. M300 Component Selection (13)

<Example 2> M300: The sum of disk drive slots exceeds the maximum supported disk drives 144.

M300 supports up to 144 disk drives and up to 7 disk enclosures. I'd like to configure M300 with 144 disk drives and 7 disk enclosures as follow.

1 x 3.5" DAC (12) + 2 x 3.5" disk enclosures (2 x 24) +

5 x 2.5" DE: 4 DEs are full of disks (4 x 24). One DE is half full (1 x 12).

Is this configuration supported? → **No, it is not supported.**



1 x DAC



7 x DE
(2 x 3.5", 5 x 2.5")

Max. number of disk drives of 3.5" DAC: 12

Max. number of disk drives of 2.5" DE: 24

Number of disk drive slots in DAC: 12

Sum of disk drive slots in 3.5" DEs: 2 x 12 = 24

Sum of disk drive slots in 2.5" DEs: 5 x 24 = 120

Total: 156

This configuration has 144 disk drives, but 156 disk drive slots that exceed 144 disk drive slots which M300 supports the maximum.

This configuration is not supported.

Use with the same caution for other M-Series models.

2. M300 Component Selection (14)

(5-2) The table of the sum of disk drive slots

As described in the section “The number of disk enclosures”, M-Series can use a mix of 3.5” and 2.5” disk enclosures at the same time. Confirm disk enclosure/disk drive configuration using the following tables.

Base Unit	Num of 3.5" DE	Num of 2.5" DE	Sum of slots	Sum of DE
M300 DAC (3.5")	0	0	12	0
	1	0	24	1
	2	0	36	2
	3	0	48	3
	4	0	60	4
	5	0	72	5
	6	0	84	6
	7	0	96	7
	0	1	36	1
	1	1	48	2
	2	1	60	3
	3	1	72	4
	4	1	84	5
	5	1	96	6
	6	1	108	7
	0	2	60	2
	1	2	72	3
	2	2	84	4
	3	2	96	5
	4	2	108	6
	5	2	120	7
	0	3	84	3
	1	3	96	4
	2	3	108	5
	3	3	120	6
	4	3	132	7
	0	4	108	4
	1	4	120	5
	2	4	132	6
	3	4	144	7
	0	5	132	5
	1	5	144	6

Base Unit	Num of 3.5" DE	Num of 2.5" DE	Sum of slots	Sum of DE
M300 DAC (2.5")	0	0	24	0
	1	0	36	1
	2	0	48	2
	3	0	60	3
	4	0	72	4
	5	0	84	5
	6	0	96	6
	7	0	108	7
	0	1	48	1
	1	1	60	2
	2	1	72	3
	3	1	84	4
	4	1	96	5
	5	1	108	6
	6	1	120	7
	0	2	72	2
	1	2	84	3
	2	2	96	4
	3	2	108	5
	4	2	120	6
	5	2	132	7
	0	3	96	3
	1	3	108	4
	2	3	120	5
	3	3	132	6
	4	3	144	7
	0	4	120	4
	1	4	132	5
	2	4	144	6
	0	5	144	5

【Basics】

3.5" DAC: 12 disk drive slots

2.5" DAC: 24 disk drive slots

3.5" DE: 12 disk drive slots

2.5" DE: 24 disk drive slots

<Example> 3.5" DAC + 3.5" DE + 4 x 2.5" DE = 12 + 12 + 4 x 24 = 120

The sum of disk driver slots is 120.

2. M300 Component Selection (15)

(5-3) DE connection



(5-4) Rack



2. M300 Component Selection (16)

(6) Dummy HDD


It is required to include a dummy HDD in a empty slot of a base unit or a disk enclosure. No dummy HDD is not included with a base unit nor disk enclosure. Purchase the required number of dummy HDD separately.

Model Number	Product Name	Accessories
NF9100-CZ25	Dummy HDD Tray (3.5") x 1	• List of accessories
NF9100-CZ29	Dummy HDD Tray (2.5") x 1	• List of accessories

2. M300 Component Selection (17)

(7) Front Bezel

No front bezel is included with the M-Series Disk Array Unit (both base unit and disk enclosure). If desired, purchase it separately.

Model number	Product name	Figure	Remarks
NF9100-SF12	Front Bezel		Key (2)

(8) Management LAN Port

M300 are equipped with two LAN ports per Disk Array Unit. Management LAN port supports the following:

- 10BASE-T/100BASE-T/1000BASE-T (Auto-negotiation)
- SNMP protocol (Version 1/2c/3)
- NEC StorageManager
- CLI commands via Telnet/SSH
- Network connector RJ-45
- Floating IP

3. Rack Guide

When mounting M-Series Disk Array in a rack, the following guidelines must be considered.

M-Series Disk Array Size

The height of storage units is standardized as “U”(1U=44.45mm/1.75inches) by EIA. Rack-mounting described below is based on the **U** number.

M-Series Disk Array : Height and Depth

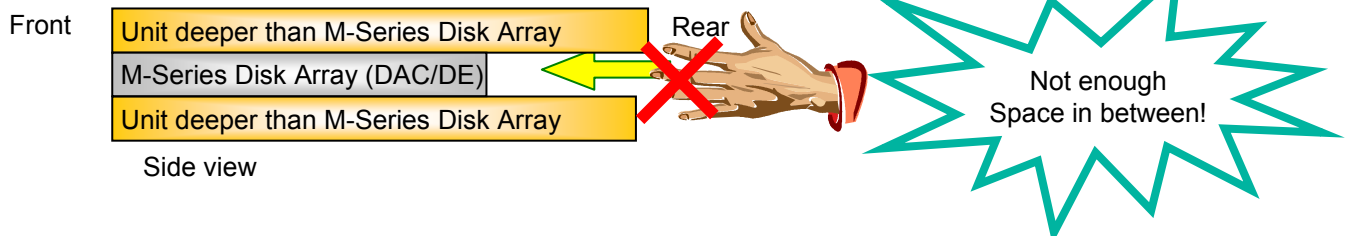
M-Series Disk Array	Disk Array Controller (DAC)	Disk Enclosure (DE)
Height	2U	2U
Depth	506mm/19.92inches	506mm/19.92inches

Mount in a Rack

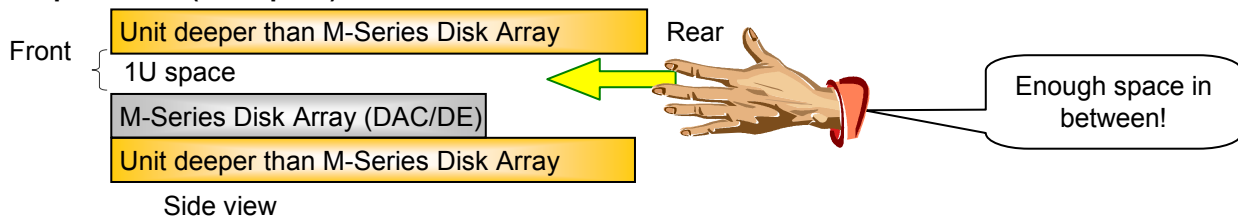
- (1) Disk Array Units do not exceed the maximum loading weight of the rack. The heavier unit is mounted in the bottom of the rack.
- (2) Each unit is mounted from the bottom with no space between. The monitor/keyboard can be positioned in the convenient level.

Caution: When mounting the units deeper than DAC or DE in M-Series Disk Array, one above the other, allow 1U space over or below.

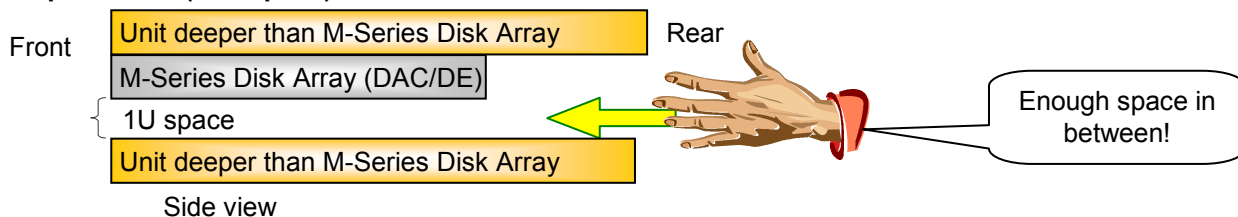
Improper Mount



Proper Mount (Example 1)



Proper Mount (Example 2)



4. Disk Drive (1)

(1) Disk Drive Size and Type

M-Series products support the following types of drives: SSD, SAS, and Nearline SAS. Performance, reliability, and price of disk drives vary depending on the type and size. Select the proper disk drive according to the intended application.

(1-1) Disk Drive Size

There are two relevant form factors of disk drives: 3.5" and 2.5".

■ 3.5" HDD

The maximum rotation speed is 15krpm for a high performance HDD. The larger 7.2krpm Nearline SAS drive topology offers an excellent cost per capacity ratio.

■ 2.5" HDD

2.5" HDD is a power saving HDD, which uses about half the electricity of the 3.5" HDD, it also saves space. One 2U chassis can support up to 24 HDDs.

(1-2) Disk Drive Type

■ SSD (Solid State Drive)

Unlike a conventional HDD, SSD does not have mechanical parts such as motors, heads and media. Reliability and random access performance is superior to conventional HDD. SSD is a "green" product because it reduces power consumption.

■ SAS HDD (Serial Attached SCSI Hard Disk Drive)

SAS HDD is excellent in reliability and performance. It is good for mission-critical systems that require high-performance and non-stop operation.

■ Nearline SAS HDD (Nearline Serial Attached SCSI Hard Disk Drive)

Nearline SAS is a high capacity and low cost HDD. It is good for backup and archive and can be used for workloads which do not require high volumes of random access I/O. Because Nearline SAS HDD has large capacity and low performance, it takes longer time to recover compared to SAS HDD.

From the perspective of reliability, double redundancy RAID types such as RAID-6 or RAID-TM are recommended.

I/F Name	SSD	SAS (3.5")	NL-SAS (3.5")	SAS (2.5")	NL-SAS (2.5")
Rotation speed	—	15krpm	7.2krpm	10krpm	7.2krpm
Avg. access time	1.0(m/s)	3.6-4.1(m/s)	8.2-9.5(ms)	3.8-4.4(ms)	8.2-9.5(ms)
Power consumption (idle) (AC)	Approx. 8W	Approx. 8W	Approx. 8W	4-5W	4-5W
Max. power consumption (AC)	9W	16-18W	11-13W	6-8W	6-8W
Max. capacity	400GB	600GB	2TB	600GB	1TB
Reliability	◎	○	△	○	△
BER (Bit error rate) at read	-	1/10 ¹⁶	1/10 ¹⁵	1/10 ¹⁶	1/10 ¹⁵
Random access performance ratio	-	2.2	1	1.6	1
Backup performance ratio	-	1.5	1	1.5	1
Restore performance ratio	-	1.1	1	1	1
Operating time		24 hours/day 365 days	8 hours/day 365 days	24 hours/day 365 days	8 hours/day 365 days
Usage	<ul style="list-style-type: none"> • High random access performance • High reliability • Lower noise 	<ul style="list-style-type: none"> • Mission-critical • High transaction 	<ul style="list-style-type: none"> • Large capacity • Backup/archive • Low workload (low random access I/O) 	<ul style="list-style-type: none"> • Mission-critical • High transaction 	<ul style="list-style-type: none"> • Large capacity • Backup/archive • Low workload (low random access I/O)

Note: The table is reference only.

4. Disk Drive (2)

(2) Disk Drive Usage

In M-Series products, disk enclosures can include a mix of SSD, SAS HDD and Nearline SAS HDDs. M-Series products provide more flexibility of choices; SAS Disk Drive for mission-critical systems that require high-performance and non-stop operation or Nearline SAS HDD for systems that require low-cost and the backup with large capacity.

(2-1) SSD

SSD is a higher price and higher performance HDD and ideal for the systems as follows:

1. Database index
2. Field applications

(2-2) SAS HDD

SAS HDD is excellent in performance, capacity and reliability. It is ideal for mission-critical systems that require high-performance at low cost as follows:

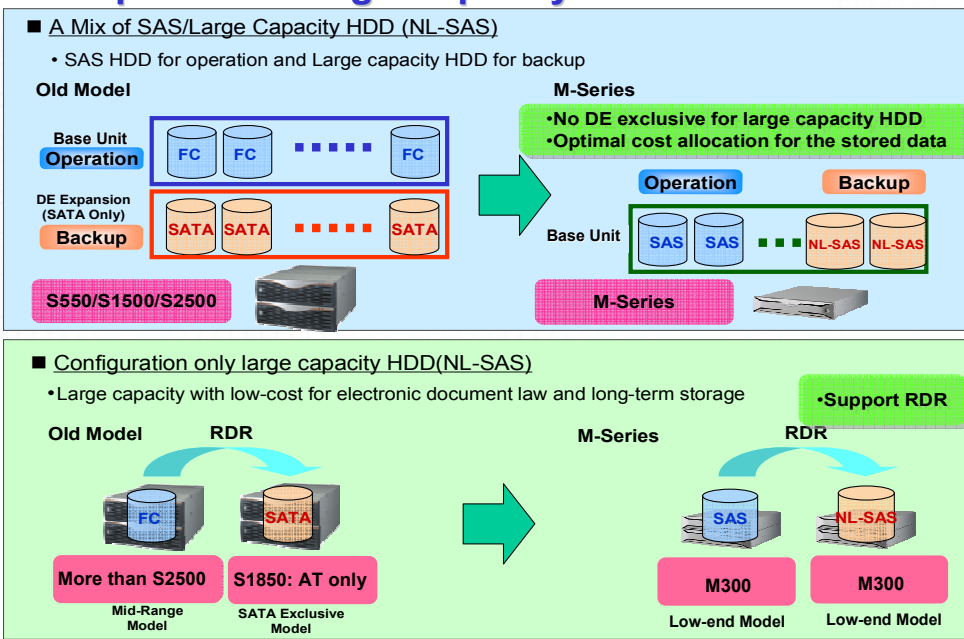
1. Frequently accessed database
2. Mission-critical applications

(2-3) Nearline SAS HDD

Nearline SAS HDD is ideal for the systems that do not require high performance but large capacity at low cost as follows:

1. Large data sets (Web, Images, Research and development data, E-mail)
2. Disk backup
3. Archive – Data protection (VolumeProtect)
4. Replication between arrays (RemoteDataReplication) – RV (Replication Volume)
5. Replication within the same array (DynamicDataReplication) – RV (Replication Volume)
6. Snapshot (DynamicSnapVolume) – SV (Snapshot Volume)
7. File Server

Example: SAS/Large Capacity HDD

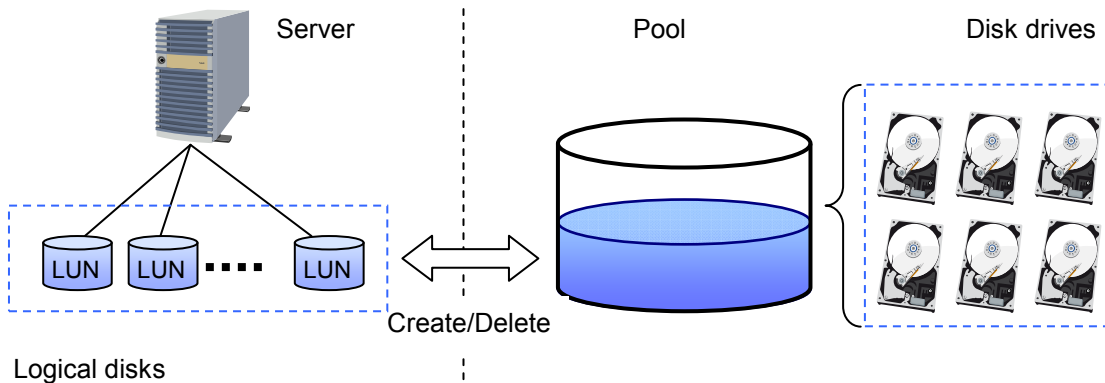


5. Functions <Pool 1>

(1) Pool

(1-1) Pool

“Pool” is a virtual storage area configured from physical disks using RAID technology. Logical disks (LUN) can be setup by allocating pool capacity to each logical disk .



(1-2) Pool Type

Pools include Basic Pools and Dynamic Pools.

- Basic Pool
 - Basic pools consist of a fixed number of physical disks.
 - It is not possible to expand pool size and logical disk capacity.
- Dynamic Pools
 - Since multiple storage areas in the pool are being managed, the data will be retained when physical disks are added and storage areas are expanded.
 - Pool capacity can be expanded with the existing data retained.
 - Logical disk capacity can be expanded with the existing data retained.
 - A logical disk allocated from the pool can be immediately used by a production server.

The M-Series products support only dynamic pools, which increases functionality and performance dynamically as well as delivers simplified operation in system management.

Note:

Since Nearline SAS disk drives have a larger capacity with lower rotation speed than traditional SAS, it requires more rebuilding time when disk failure occurs, which may lead to another failure. RAID types such as RAID-6 or RAID-TM, which have multiple layers of redundancy, are strongly recommended because they provide more reliability.

5. Functions <Pool 2>

(2) Pool and Logical Disk: Configuration and Expansion

(2-1) Configuring a pool

It is recommended that a RAID consists of a combination of physical disks of the same capacity and same rotation speed. The space configured in a pool is available to bind logical disks immediately.

The following list describes minimum and maximum disk drives in a dynamic pool. Refer to “Appendix: Dynamic Pool Capacity List” for pool capacity.

RAID Type	Configuration	Min. number of disk drives	Capacity utilization	Max. number of disk drives
RAID-1/10	$(1 + 1) \times n$	2	50%	M100: 96 M300: 96 (3.5") 144 (2.5")
RAID-5/50	$(2 + P) \times n$	3	66%	
	$(4 + P) \times n$	5	80%	
	$(8 + P) \times n$	9	88%	
RAID-6/60	$(4 + PQ) \times 2$	6	66%	
	$(8 + PQ) \times 2$	10	80%	
RAID-TM	$(1 + 1 + 1) \times n$	3	33%	

* SSD: RAID-1, 10, 5(4+P), 50(4+P) only.

Note: Striping and the number of HDDs (RAID-10/50/60/TM)

A dynamic pool can be built with any combination of RAID type and number of HDD by using virtualization technology. Striping is automatic when configuring a pool with more than twice the minimum number of HDDs in each RAID type. For example, RAID-1 with 4 HDDs is automatically configured as RAID-10. It is also possible to configure a pool with 3 HDDs in RAID-1, in which case, it will be equivalent to the striping effect of RAID-10.

Note: Pool Configuration

In M-Series products, a system volume which manages performance logs etc is automatically created in the pool first created. The capacity of a system volume is 8.6GB (1GB=1000³Byte) / 8.0GB(1G=1024³Byte).

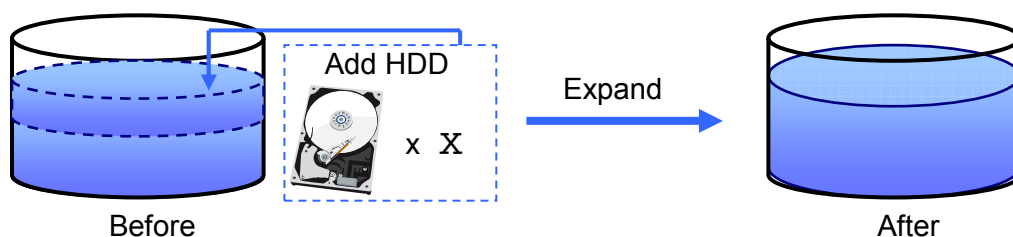
When using DynamicDataReplication, it is recommended to create the master volume (MV) and the replication volumes (RV) in the different pool. When using DynamicDataReplication or RemoteDataReplication, it is also recommended to use the storage system information retention function and configure replication reserved volume by NEC StorageManager. The capacity of a replication reserved volume is 8.6GB(1GB=1000³Byte) / 8.0GB(1G=1024³Byte).

* Storage system information retention function: backup storage system information such as the differential map between business volume (MV) and replication volume (RV) onto disk drives. Refer to “5. Functions <Storage System Information Retention Function>” for more details.

5. Functions <Pool 3>

(2-2) Expanding the Pool Capacity

You can expand the capacity of an existing pool by adding unused physical disks and incorporating them into the pool. The added space becomes available to use for binding a new logical disk or expanding the existing logical disk capacity. The expansion time depends on the pool type and the number of disk drives added. Expansion can be executed on line during operation.



RAID type	Configuration	Number of immediately accessible disks ^{*1}	Number of immediately non-accessible disks ^{*2}
RAID-1/10	$(1+1) \times n$	More than 2	1
RAID-5/50	$(2 + P) \times n$	More than 3	1-2
	$(4 + P) \times n$	More than 5	1-4
	$(8 + P) \times n$	More than 9	1-8
RAID-6/60	$(4 + PQ) \times n$	More than 6	1-5
	$(8 + PQ) \times n$	More than 10	1-9
RAID-TM	$(1 + 1 + 1) \times n$	More than 3	1-2

^{*1} When adding the following number of physical disks, the expansion is completed immediately and the logical disks are available for configuration.

^{*2} When adding the following number of physical disks, the expansion time depends on the capacity and the number of the added physical disks. The logical disks are available for configuration after the expansion completes. (It takes approximately 5 hours for one 147GB HDD to expand.) The logical disks are available for configuration after the expansion completes. The pool has approximately 10% more I/O load while expanding.

5. Functions <Pool 4>

(2-3) Configuring Logical Disks

You can configure logical disks by allocating the required amount from the unused space in the dynamic pool.

- The maximum number of logical disk is 1024 per 1 dynamic pool.
- The minimum capacity of logical disk for configuration is 1GB.
- The unit of logical disk for configuration is 1GB.
- The maximum size of a logical disk which can be used as a snapshot volume is 10TB.
- DDR and MV can be created up to 10TB.
- The logical disks can be used immediately after they are configured. (Quick LUN configuration function) Formatting of logical disks is run in the background.

(2-4) Expanding Logical Disk Capacity Function

- Expansion can be executed on line during operation.
- Logical disk capacity can be expanded with retention of the existing data.
- When expanding a logical disk, unused space in the same pool is available for the expansion.
Note: The unused space must exist in a pool in which logical disks belong.
- After increasing capacity, the space, including any additional space, is available for use.
Note: The procedure for adding space vary depending on the server OS. Reboot may be required depending on the OS.

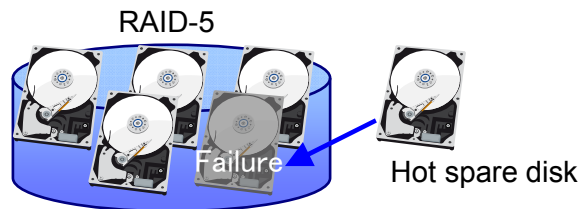
OS	Procedure
Windows Server 2003/2008	Extended volume is recognized with "diskpart" command
Linux	<p>The file system can not be expanded when expanding a logical disk. Do the following procedures;</p> <ol style="list-style-type: none">a) Back up the contents of a logical disk to media such as a tape, etc.b) Expand the logical disk.c) Rebuild the file system in the expanded logical disk. Note: The data in the logical disk is deleted.d) Restore the data from backup media such as a tape in the rebuilt file system.

5. Functions <Hot Spare Disk (1)>

(1) Hot Spare Disk

Binding the hot spare disk enables automatic restoration of data when a disk failure occurs, without having to wait for a maintenance service agent. Data redundancy is restored when the data copy to the hot spare disk is complete.

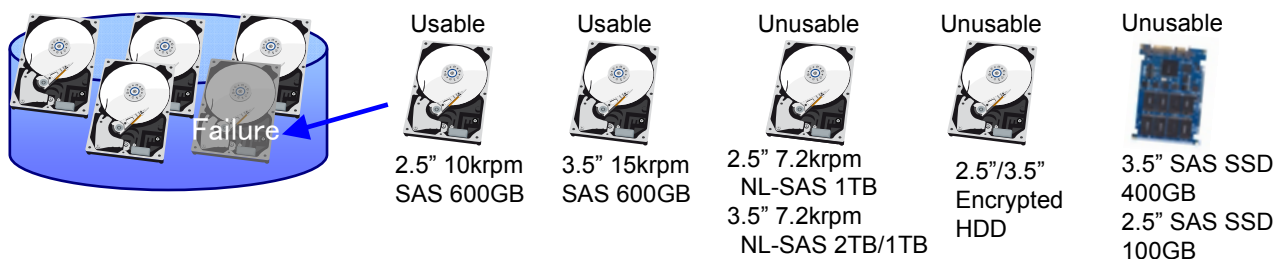
<Example>



- Binding of hot spare disk(s) is strongly recommended in order to enhance the availability of disk array unit.
- The unit has a global hot spare function which enables hot spare disks to be used in any RAID group. Note that SSD hot spare is only good with SSDs. SSD cannot be used as a hot spare with HDDs. Likewise, HDD cannot be used as a hot spare with SSDs.
- A pool cannot consist of a mix which includes encrypted and unencrypted HDDs. Encrypted HDDs also cannot be used as hot spares for unencrypted HDDs.
- A hot spare disk protects disk drives with the following characteristics.
 - The same interface as hot spare disk
 - The same amount of capacity or less as hot spare disk
 - The same speed of rotations or less as hot spare disk
- When there are disks with various capacities and rotation speeds within the disk array unit, it is recommended to have hot spare disks for each disk with the same capacity and the same rotation speed to make management easier. (Note that SAS and Nearline SAS are different interfaces.)

<Example>

2.5" 10krpm SAS 300GB RAID



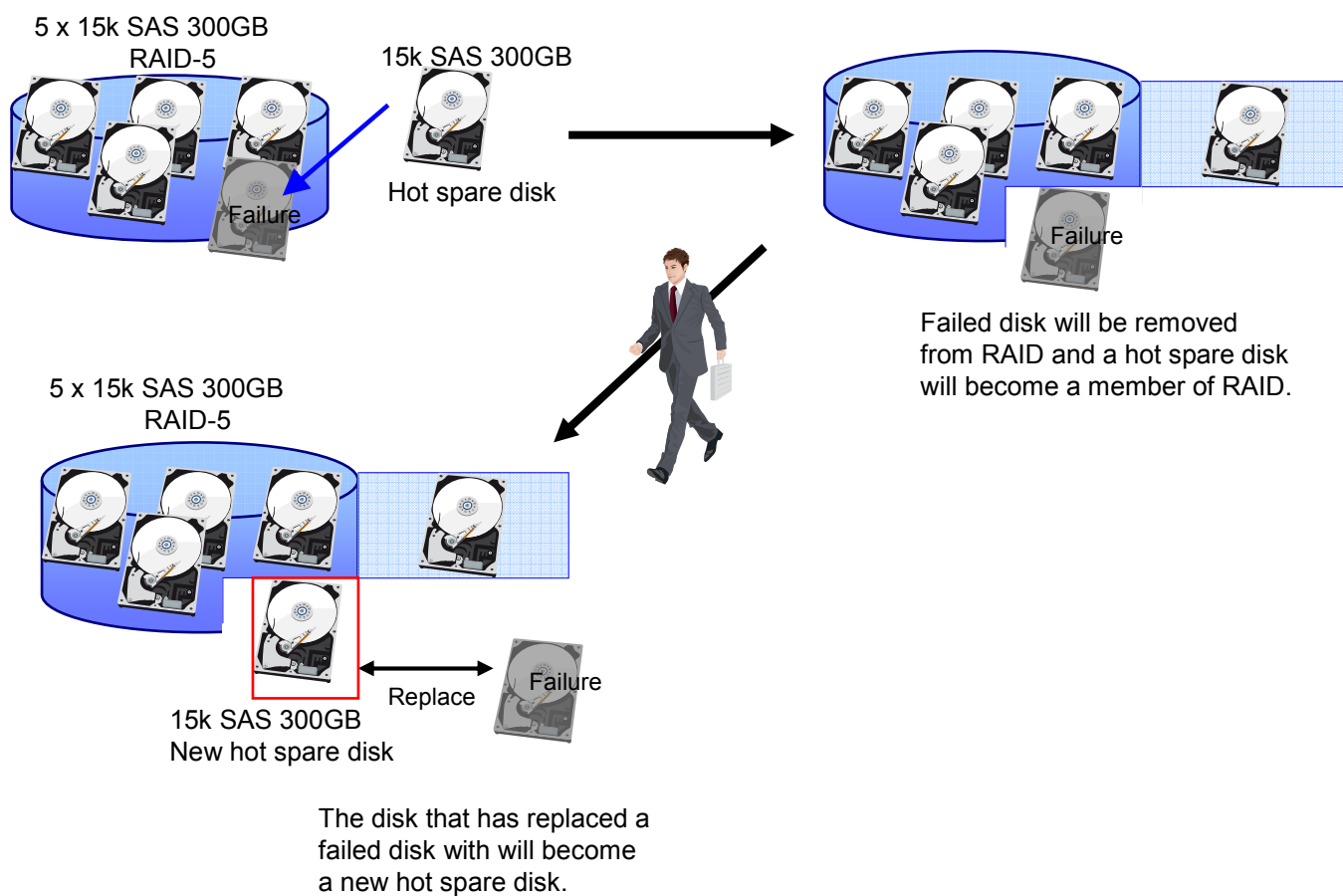
- When multiple types of disk drives are defined as hot spare disks, the priority is as follows.
 1. The same interface, the same capacity and the same rotation speed as the base disk drive*.
 2. The same interface and the same capacity as the base disk drive* but the slower disk used first when multiple speeds of hot spare drives exist.
 3. The same interface as the base disk drive*, but larger than the base disk drive*. When multiple sizes of hot spare disks exist, the smaller disk is used first.
- * Base disk drive = disk drive with the smallest capacity/slowest rotation speed in the pool.

5. Functions <Hot Spare Disk (2)>

(2) Operation of Rebuilding Data to Hot Spare Disk

Copy Back Mode: Off (Default)

After the data is restored, the replaced disk is automatically designated as the hot spare disk. When replacing the hot spare disk with the same capacity/rotation speed, data is not copied back. However, when a hot spare disk with larger capacity/higher rotation speed is replaced with a disk drive of smaller capacity/lower rotation speed, the data is copied back to its original location (on the replaced disk).



Copy Back Mode: On

When replacing a failed disk with a new normal disk, and after the data restore has completed, data on the hot spare disk is copied back to the new disk. When copy back mode is in progress, scheduled maintenance (multi hot spare disk function) is not available. Refer to NEC StorageManager for copy back mode setting.

5. Functions <Hot Spare Disk (3)>

(3) The Number of Hot Spare Disk Drive

- There is no upper limit for the number of hot spare disks.
- Bind hot spare disks when Nearline SAS disk drives are in the system.
- Refer to the table below for the recommended numbers of hot spare disks for each type of disk drive.

Recommended number of hot spare disk drives

Disk drive type	Condition	Recommendation
SAS Disk Drive	One type of capacity/rotation speed	One hot spare drive / 24 disk drives
	n types of capacity/rotation speed	n spare disk drives / 24 disk drives
Nearline SAS Disk Drive ^{*1}	One type of capacity/rotation speed	One hot spare drive / 12 disk drives
	n types of capacity/rotation speed	n spare disk drives / 12 disk drives
SAS SSD	Hot spare is optional. Because SAS SSD does not have mechanical parts such as motors, heads and media, it is reliable. Therefore, hot spare is not necessary.	

^{*1} Must assign hot spare disks when Nearline SAS disk drives are in the system.

5. Functions <Storage System Information Retention Function>

Storage System Information Retention Function

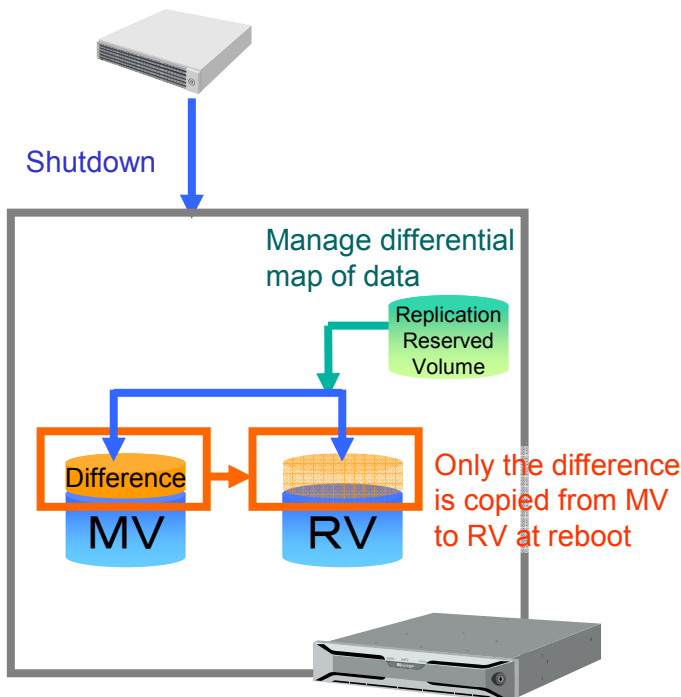
When using the data replication function, the storage system data such as the differential map between the master volume (MV) and the replication volumes (RV) is created in the cache memory. The storage system information retention function backs up the storage system data to a disk drive. The volume to backup, which is called "replication reserved volume", can be configured by the procedures in the NEC StorageManager manual.

It is strongly recommended to use the storage system information retention function when using data replication function. When not using the storage system information retention function, the updated difference data is not saved when rebooting after the scheduled plan is completed, and requires a full copy of data in MV to RV. Until copying of the entire data completes, an I/O load occurs which affects the performance of operation. The replication reserved volume is 8.6GB (1GB=1000³Byte) / 8.0GB (1G=1024³Byte).

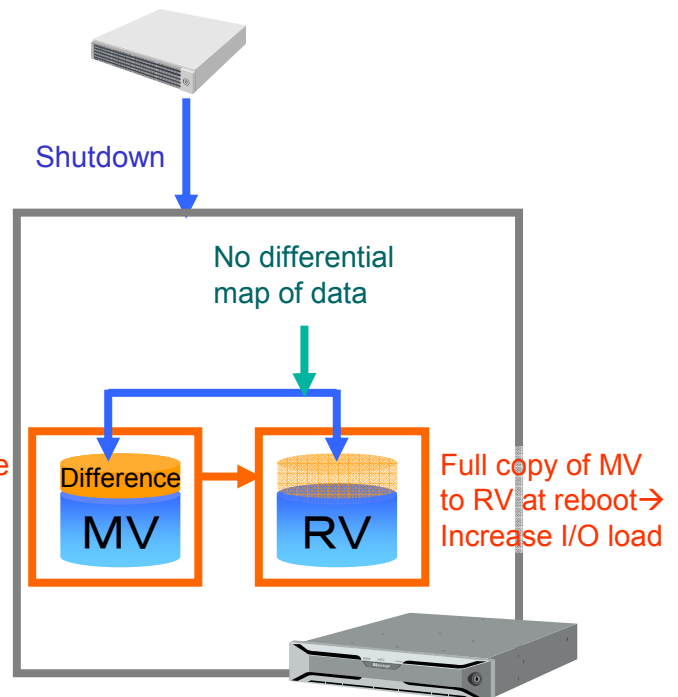
Note:

Storage system information retention function is used for the planned stoppage to restore the storage system information during the shutdown procedure but will not work for a power outage.

1. Replication Reserved Volume



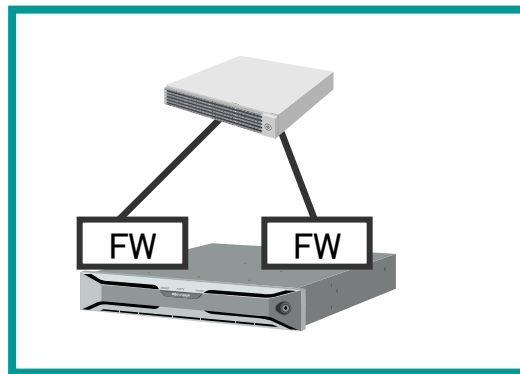
2. No Replication Reserved Volume



5. Functions <Automatic Online Firmware Update>

Automatic Online Firmware Update

M-Series firmware is compliant with ALUA. Firmware can be updated to the latest version without stopping the system with the NEC Storage M-Series.



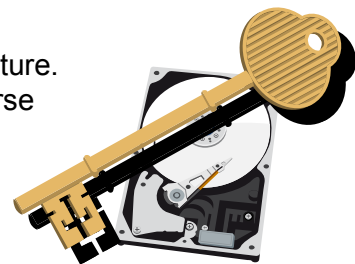
The following environment is required in order to perform automatic online firmware updates:

- Multipath Software: NEC Storage PathManager or OS native multipath software
- Dual Controllers (2 CONT Configuration)

5. Functions <Encryption Feature (1)>

Encryption Feature

M-Series supports SED (Self Encryption Drive) as a hard drive encryption feature. SED prevents access to data in case of stolen hard drives. SED has no adverse impact on performance.



(1) SED type HDD

- Encrypt data on the hard drive itself (media, cache)
- Protect against a data breach by hard drive theft
- Embedded encryption chip on the hard drive. No performance degradation with encryption.

(2) Supported SED HDDs

M-Series supports the following SED HDDs.

Model	Interface	Transfer rate (bps)	Size	Rotation speed (rpm)	Capacity
NF5321-SM728SDE	SAS	6G	3.5"	15k	600GB
NF5321-SM768SDE	SAS	6G	2.5"	10k	600GB

5. Functions <Encryption Feature (2)>

(3) How to setup encryption

- When binding a pool with NEC StorageManager, see physical disk type. SED support/non-support of hard disks is displayed.
- Encryption is enabled as encrypted hard drive's default settings.
- After binding a pool, protect an encryption key within hard drives by modifying authentication key using authentication key setting tool (CLI).

(4) Notes for encryption

- A disk array can consist of mix of encrypted hard drives (SED HDD) and unencrypted hard drives (non-SED HDD).
- A pool cannot consist of mix which includes encrypted hard drives and unencrypted hard drives. Bind hot spare disks for both encrypted hard drives and unencrypted hard drives.
- When data stored in SED HDD is replicated to non-SED HDD, the data replicated to non-SED HDD will not be encrypted.
- When creating snapshot of data in SED HDD, create SRA (Snapshot Reserved Area) in SED HDD. If SRA is created in non-SED HDD, SV (Snapshot Volume) will not be encrypted.
- A pool cannot be bound Immediately after unbinding a pool with SED HDDs. Wait a few minutes, and then bind a pool. If it fails, wait another few minutes, then bind a pool. A logical disk can be bound immediately after unbinding a logical disk.

5. Functions <Power Saving Function (2)>

Power consumption by using MAID technology

				HDD	Max. [W]	Standby [W]	Using MAID [W] *1	Reduction Rate from Standby
M100	3.5"	FC	DAC	SAS15K	485	345	260	24.6%
	2.5"	FC	DAC	SAS10K	495	355	260	26.8%
	3.5"	-	DE	SAS15K	315	215	80	62.8%
	2.5"	-	DE	SAS10K	315	225	110	51.1%
	3.5"	FC	DAC	NL-SAS	420	285	235	17.5%
	2.5"	FC	DAC	NL-SAS	460	275	245	10.9%
	3.5"	-	DE	NL-SAS	250	150	80	46.7%
	2.5"	-	DE	NL-SAS	280	140	110	21.4%
M300	3.5"	FC	DAC	SAS15K	500	360	270	25.0%
	2.5"	FC	DAC	SAS15K	495	370	275	25.7%
	2.5"	FC	DAC	SAS10K	495	370	275	25.7%
	3.5"	-	DE	SAS15K	315	215	80	62.8%
	2.5"	-	DE	SAS10K	315	225	130	42.2%
	2.5"	-	DE	SAS15K	310	225	110	51.1%
	3.5"	FC	DAC	NL-SAS	435	295	255	13.6%
	2.5"	FC	DAC	NL-SAS	460	285	260	8.8%
	3.5"	-	DE	NL-SAS	250	150	80	46.7%
	2.5"	-	DE	NL-SAS	280	140	110	21.4%

*1 DAC: The first four disks are reserved as system disks and not applicable for MAID.

Note: Controller/HDD fully loaded

(2) Automatic FAN rotation speed function

The FAN rotation speed function controls the rotation speed of a FAN as the environment changes and reduces power consumption.

Ambient temperature (Surrounding Temperature)	FAN rotation	FAN power consumption
Up to 30° C	Low-speed	Approx. 16W
30 - 35° C	Medium-speed	Approx. 32W
Over 35° C	High-speed	Approx. 56W

5. Functions <VAAI Support (1)>

VAAI Support

(1) Server Virtualization

Typically server's CPU utilization is low. To utilize the remaining resources, use server virtualization to run multiple virtual machines on one physical server. There are many server virtualization software products. VMware is one of the better known products and is widely used.

(2) Optimize Storage Performance

VMware vSphere has VAAI (vStorage API for Array Integration) that optimizes storage performance. M-Series supports the following three VAAI features.

- Full Copy
- Block Zeroing
- Hardware-Assisted Locking

Overview of these features can be found in the following pages.

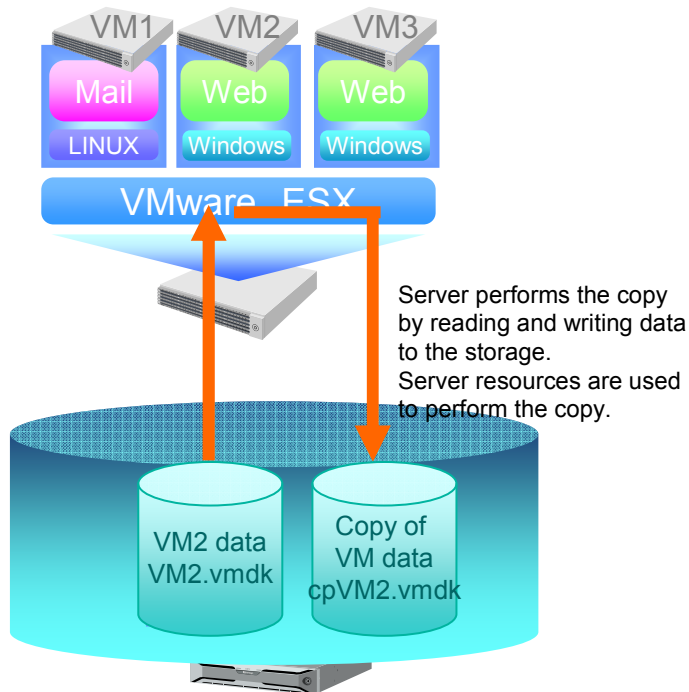
(3) VAAI Support Settings

VAAI support settings can be configured by NEC StorageManager.

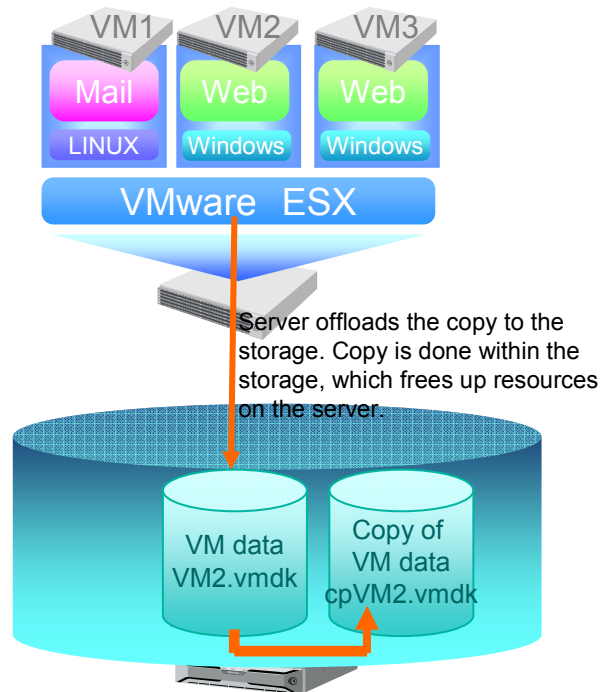
5. Functions <VAAI Support (2)>

■ Full Copy

1. Copy Virtual Machine (VAAI disabled)



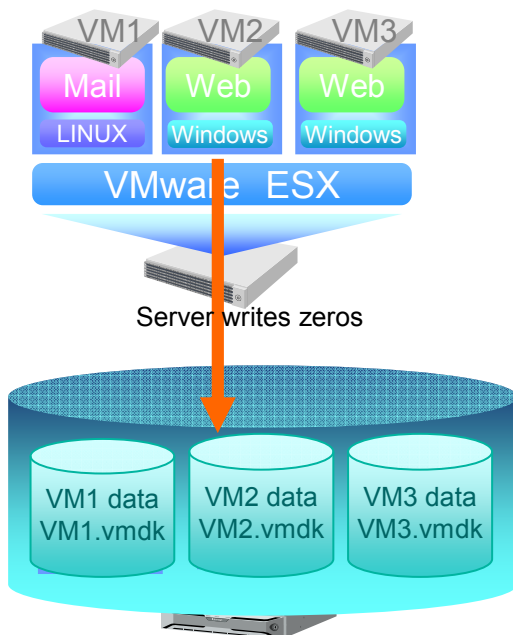
2. Copy Virtual Machine (VAAI enabled)



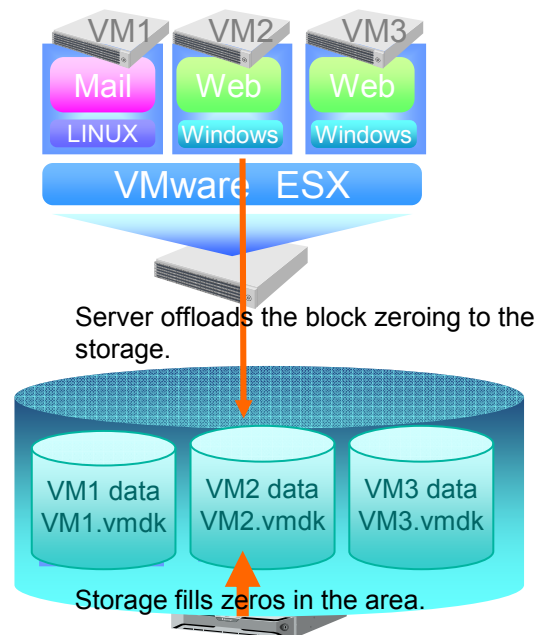
■ Block Zeroing

Block zeroing is used in various scenarios. (For example, fill free disk space with zeros in order to make virtual disk file optimal size.)

1. VAAI Disabled



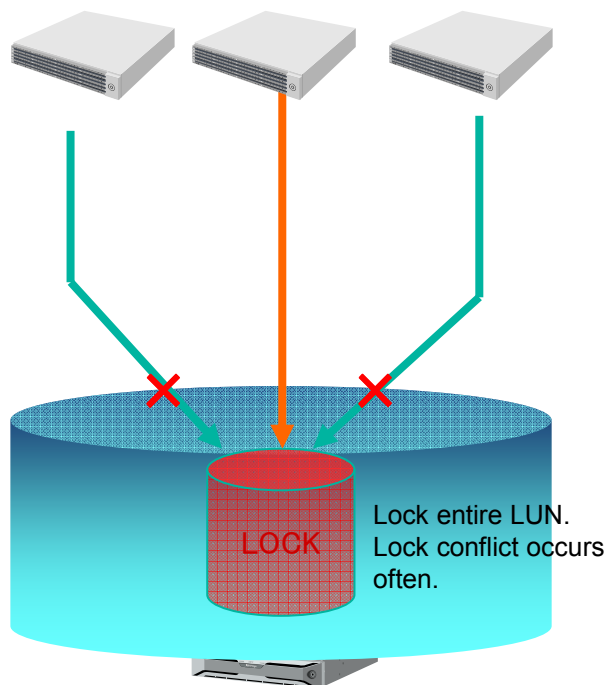
2. VAAI Enabled



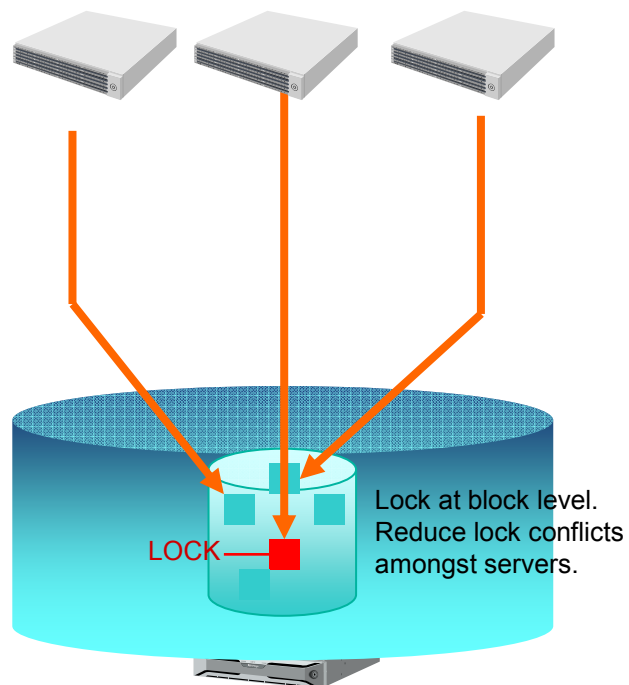
5. Functions <VAAL Support (3)>

■ Hardware-Assisted Locking

1. Without Hardware-Assisted Locking



2. With Hardware-Assisted Locking



5. Functions <Data Replication/Snapshot (1)>

Data Replication/Snapshot Consideration

(1) Data Replication

When using Data Replication (only), the maximum capacity of replication volume (RV) is as follows.

Model	Total capacity of dynamic pool	Max. capacity of RV/MV	Total capacity of RV
M100/M300	~ Max. Capacity	256TB	500TB

■ Data Replication Type Support Matrix

	In-box replication (DynamicDataReplication)	Inter-box replication (RemoteDataReplication)
Model	M100/M300	M100/M300
8Gb FC Host I/F	○	○
1Gb iSCSI Host I/F	○	-
10Gb iSCSI Host I/F	○	-
Single Controller	-	-
Dual Controller	○	○
NEC StorageManager Express (Embedded)	○	-
NEC StorageManager Suite	○	○

○ : Supported

— : Not supported

5. Functions <Data Replication/Snapshot (2)>

(2) Snapshot

When using Snapshot (only), the maximum capacity of snapshot related volumes is as follows.

Model	Total capacity of dynamic pool	Sum of snapshot related volumes	Max. size of LD for snapshot	Max. generation of snapshots
M100/M300	~ Max. Capacity	160TB	10TB	16

■ Snapshot Support Matrix

	Snapshot (DynamicSnapVolume)
Model	M100/M300
8Gb FC Host I/F	○
1Gb iSCSI Host I/F	○
10Gb iSCSI Host I/F	○
Single Controller	-
Dual Controller	○
NEC StorageManager Express (Embedded)	○
NEC StorageManager Suite	○

Sum of Snapshot Related Volumes

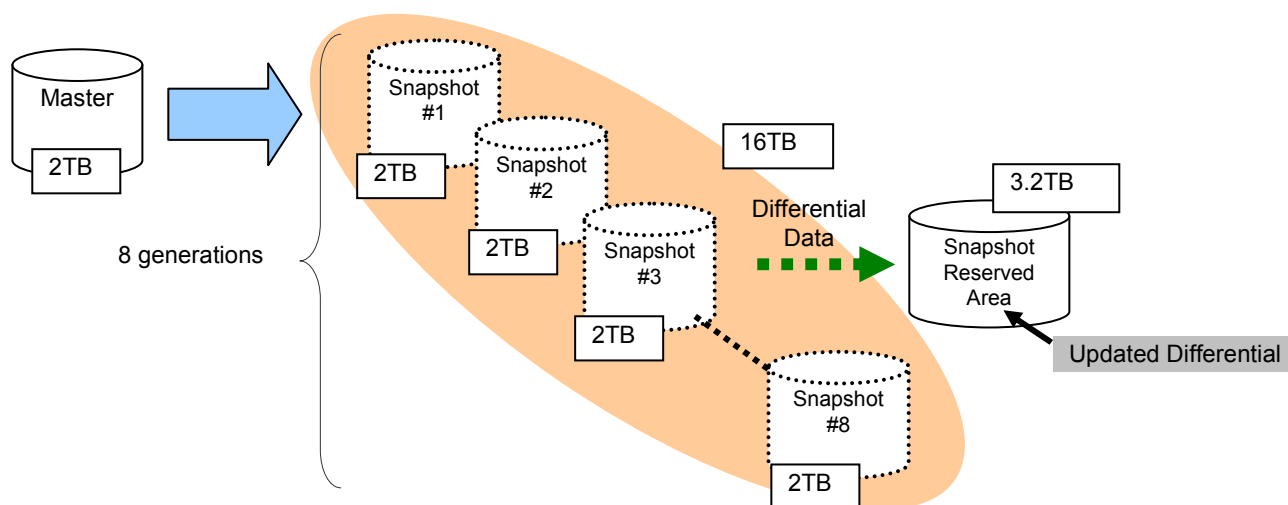
= Master Volume Capacity + Snapshot Volume Capacity + Snapshot Reserved Area Capacity

<Calculation Example>

Master Volume 2TB has 8 generations of snapshot volumes and the snapshot reserved area per generation is 20%.

Snapshot Reserved Area = 2TB × 20% × 8 = 3.2TB

Sum of Snapshot Related Volumes = 2TB + 16TB + 3.2TB = 21.2TB



5. Functions <Data Replication/Snapshot (3)>

(3) Data Replication and Snapshot

When using Data Replication and Snapshot (both), the maximum capacity of the replication volume (RV) and the maximum capacity of snapshot related volumes are as follows.

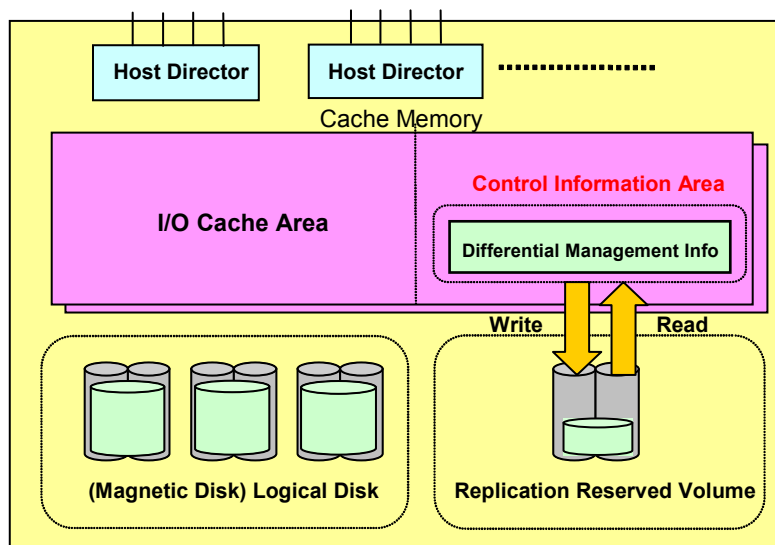
When the replication reserved volume is created, the sum of RV capacity is 500TB. When the number exceeds the table below, the performance will be degraded because the replication reserved volume will be accessed.

Model	Max. capacity	Sum of RV capacity	Sum of Snapshot Related Volumes
M100/M300 (FC)	~ Max. Capacity	50TB	16TB
		45TB	32TB
		40TB	48TB
		35TB	64TB
		30TB	80TB
		25TB	96TB
		20TB	112TB
		15TB	128TB
		10TB	144TB
		5TB	160TB
M100/M300 (1Gb iSCSI)	~ Max. Capacity	50TB	16TB
		45TB	32TB
		40TB	48TB
		35TB	64TB
		30TB	80TB
		25TB	96TB
		20TB	112TB
		15TB	128TB
		10TB	144TB
		5TB	160TB
M100/M300 (10Gb iSCSI)	~ Max. Capacity	50TB	16TB
		45TB	32TB
		40TB	48TB
		35TB	64TB
		30TB	80TB
		25TB	96TB
		20TB	112TB
		15TB	128TB
		10TB	144TB
		5TB	160TB

5. Functions <Data Replication/Snapshot (4)>

Note:

The control information area in cache memory is used for differential management information. When the control information area overflows, it is no longer possible to store all pair information in it. In this case the replication reserved volume is also used. Information which is less frequently accessed is stored on this volume in order to store more pair differential management information. The system also writes information in this volume and reads from it. Because of this physical disk access, overall performance may be degraded.

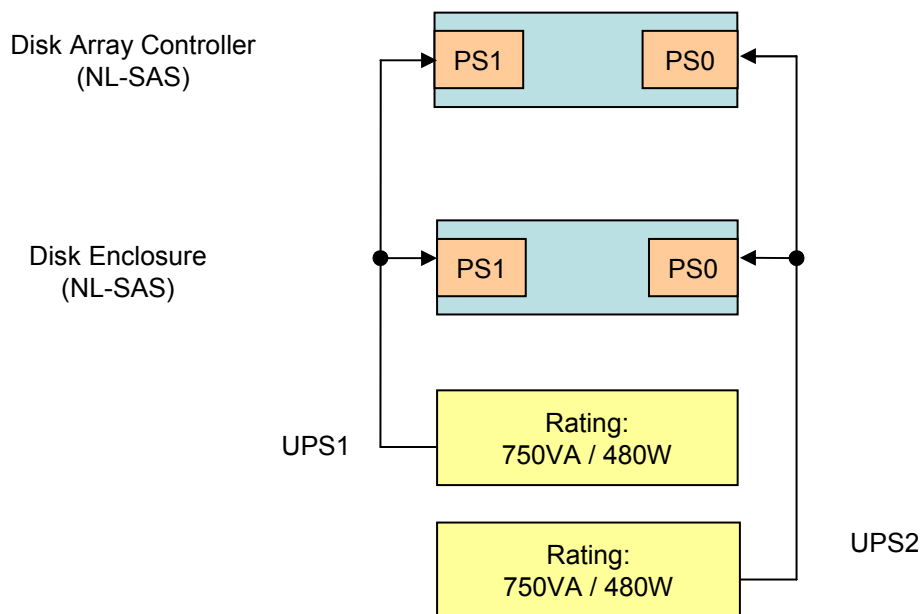


5. Functions <UPS Considerations>

UPS Considerations

1. Select a UPS to meet both the apparent power (VA) and the active power (W) requirements of the storage disk array unit. Refer to the UPS manual for more details.
2. Storage units have redundant power supplies, there are two AC inputs in each unit. Both power supplies are in use during normal operation. In the event of one power supply should fail, due to a tripped breaker off or UPS failure, the remaining power supply is capable of providing power. Make sure that the selected UPS is capable of providing sufficient and reliable power for all devices.

■ Example: Improper configuration for active power



	UPS normal load		UPS2 failure
	PS1	PS0	
M100 (3.5") Disk Array Controller power consumption (NL-SAS)	212.5VA/210W	212.5VA/210W	425VA/420W
Disk Enclosure power consumption (NL-SAS)	127.5VA/125W	127.5VA/125W	255VA/250W
UPS1 load power	340VA/335W	-	680VA/670W The active power exceeds the UPS rating level.
UPS2 load power	-	340VA/335W	(Fail)

3. When using a standby type UPS (requires a sensitivity mode setting) specific configuration elements must be addressed. In order to ensure reliable power in the event of an outage, set the sensitivity mode transfer time from the commercial power source to the battery power to 20ms or less.

5. Functions <E-mail Notification Function>

E-mail Notification Function

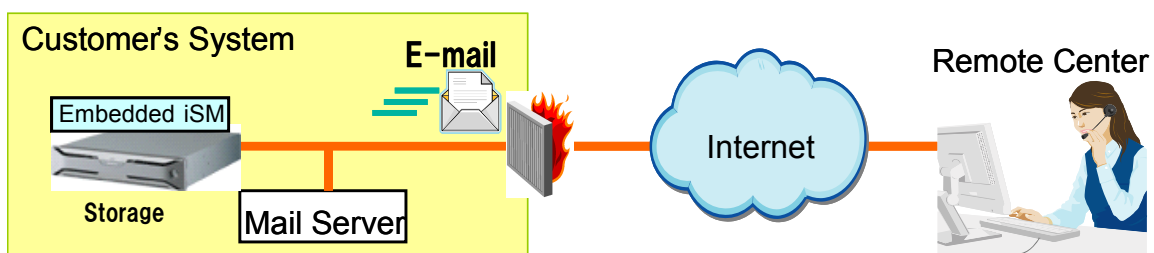
In M-Series, when a hardware failure occurs, NEC StorageManager (iSM) notifies the remote center of the details about the failure via an e-mail.

Environment

The followings describe the configuration of the e-mail notification function.

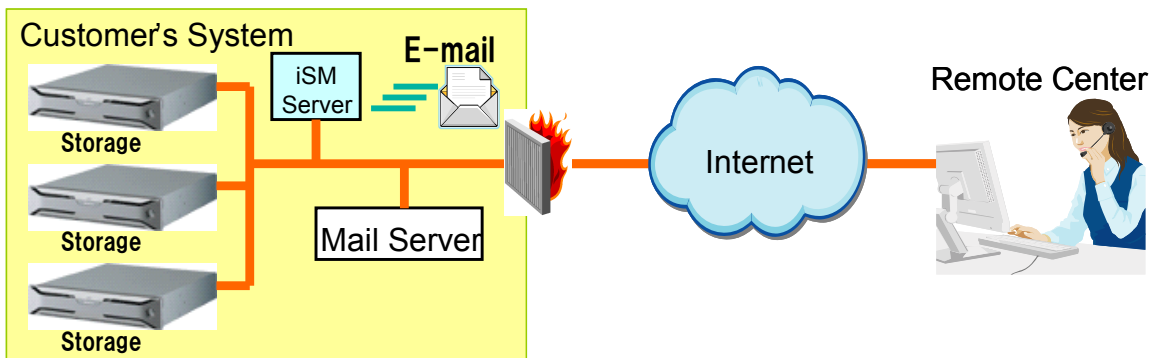
1. E-mail notification from the storage unit (iSM embedded)

NEC StorageManager is embedded in a storage unit.



2. E-mail notification from the storage units via iSM Server

NEC StorageManager is installed apart from the storage units. One NEC StorageManager Server can notify a remote center of the events in multiple storage units.



5. Functions <Battery Lifetime>

Battery Lifetime

The wear/lifetime of the battery is set for the hardware stable operation in M-Series. When purchasing NEC products, it is recommended to review the wear/lifetime specifications and replacement costs. It may be necessary to replace a battery for operation stability prior to the recommended replacement time in the list below.

(1) Wear/Lifetime for stable operation

Disk Array Unit	5 years
-----------------	---------

(2) Unit necessary to replace separately

Item	Wear/Lifetime	Replacement Unit	Cost
Battery	5 years	Battery	Additional

Battery Replacement

The NEC Disk Array Unit performance is enhanced when write-cache is on. The battery power is used to retain the data on cache when an unplanned disconnection such as a power outage occurs. The battery power is consumed while the disk array is running. It is necessary to replace the battery in about five years*. This replacement can be done while the system is running.

* The lifetime of the battery is shortened when it is used at high temperature. Whereas it is about five years at an ambient temperature of 25°C (77°F), it decreases to about half (two years and six months) when the ambient temperature rises 10°C (18°F). As the frequency of battery backup increases, the lifetime of battery decreases. This lifetime above is calculated considering only an unplanned power disconnection such as power outage.

Appendix: Dynamic Pool Capacity List (1)

■ RAID Type: RAID-1/RAID-TM ■ Disk Drive Type: SAS ■ 1GB = 1024³ Byte

# of Disk Drive	RAID-1(1+1)			RAID-TM(1+1+1)		
	300GB	450GB	600GB	300GB	450GB	600GB
1	-	-	-	-	-	-
2	262	404	530	-	-	-
3	395	608	797	263	406	532
4	524	808	1061	352	542	710
5	657	1012	1328	440	678	888
6	786	1212	1591	527	812	1064
7	919	1416	1858	615	948	1242
8	1048	1616	2122	704	1084	1420
9	1181	1820	2389	790	1218	1596
10	1310	2020	2652	879	1354	1774
11	1443	2224	2919	967	1490	1952
12	1572	2424	3183	1054	1624	2128
13	1705	2628	3450	1142	1760	2306
14	1834	2828	3713	1231	1896	2484
15	1967	3032	3980	1317	2030	2660
16	2096	3232	4244	1406	2166	2838
17	2229	3436	4511	1494	2302	3016
18	2358	3636	4774	1581	2436	3192
19	2491	3840	5041	1669	2572	3370
20	2620	4040	5305	1758	2708	3548
21	2753	4244	5572	1844	2842	3724
22	2882	4444	5835	1933	2978	3902
23	3015	4648	6102	2021	3114	4080
24	3144	4848	6366	2108	3248	4256
25	3277	5052	6633	2196	3384	4434
26	3406	5252	6896	2285	3520	4612
27	3539	5456	7163	2371	3654	4788
28	3668	5656	7427	2460	3790	4966
29	3801	5860	7694	2548	3926	5144
30	3930	6060	7957	2635	4060	5320
31	4063	6264	8224	2723	4196	5498
32	4192	6464	8488	2812	4332	5676
33	4325	6668	8755	2898	4466	5852
34	4454	6868	9018	2987	4602	6030
35	4587	7072	9285	3075	4738	6208
36	4716	7272	9549	3162	4872	6384
37	4849	7476	9816	3250	5008	6562
38	4978	7676	10079	3339	5144	6740
39	5111	7880	10346	3425	5278	6916
40	5240	8080	10610	3514	5414	7094
41	5373	8284	10877	3602	5550	7272
42	5502	8484	11140	3689	5684	7448
43	5635	8688	11407	3777	5820	7626
44	5764	8888	11671	3866	5956	7804
45	5897	9092	11938	3952	6090	7980
46	6026	9292	12201	4041	6226	8158
47	6159	9496	12468	4129	6362	8336
48	6288	9696	12732	4216	6496	8512
49	6421	9900	12999	4304	6632	8690
50	6550	10100	13262	4393	6768	8868

# of Disk Drive	RAID-1(1+1)			RAID-TM(1+1+1)		
	300GB	450GB	600GB	300GB	450GB	600GB
51	6683	10304	13529	4479	6902	9044
52	6812	10504	13793	4568	7038	9222
53	6945	10708	14060	4656	7174	9400
54	7074	10908	14323	4743	7308	9576
55	7207	11112	14590	4831	7444	9754
56	7336	11312	14854	4920	7580	9932
57	7469	11516	15121	5006	7714	10108
58	7598	11716	15384	5095	7850	10286
59	7731	11920	15651	5183	7986	10464
60	7860	12120	15915	5270	8120	10640
61	7993	12324	16182	5358	8256	10818
62	8122	12524	16445	5447	8392	10996
63	8255	12728	16712	5533	8526	11172
64	8384	12928	16976	5622	8662	11350
65	8517	13132	17243	5710	8798	11528
66	8646	13332	17506	5797	8932	11704
67	8779	13536	17773	5885	9068	11882
68	8908	13736	18037	5974	9204	12060
69	9041	13940	18304	6060	9338	12236
70	9170	14140	18567	6149	9474	12414
71	9303	14344	18834	6237	9610	12592
72	9432	14544	19098	6324	9744	12768
73	9565	14748	19365	6412	9880	12946
74	9694	14948	19628	6501	10016	13124
75	9827	15152	19895	6587	10150	13300
76	9956	15352	20159	6676	10286	13478
77	10089	15556	20426	6764	10422	13656
78	10218	15756	20689	6851	10556	13832
79	10351	15960	20956	6939	10692	14010
80	10480	16160	21220	7028	10828	14188
81	10613	16364	21487	7114	10962	14364
82	10742	16564	21750	7203	11098	14542
83	10875	16768	22017	7291	11234	14720
84	11004	16968	22281	7378	11368	14896
85	11137	17172	22548	7466	11504	15074
86	11266	17372	22811	7555	11640	15252
87	11399	17576	23078	7641	11774	15428
88	11528	17776	23342	7730	11910	15606
89	11661	17980	23609	7818	12046	15784
90	11790	18180	23872	7905	12180	15960
91	11923	18384	24139	7993	12316	16138
92	12052	18584	24403	8082	12452	16316
93	12185	18788	24670	8168	12586	16492
94	12314	18988	24933	8257	12722	16670
95	12447	19192	25200	8345	12858	16848
96	12576	19392	25464	8432	12992	17024

Appendix: Dynamic Pool Capacity List (2)

■ RAID Type: RAID-5(2+P/4+P/8+P) ■ Disk Drive Type: SAS ■ 1GB = 1024³ Byte

# of Disk Drive	RAID-5(2+P)			RAID-5(4+P)			RAID-5(8+P)		
	300GB	450GB	600GB	300GB	450GB	600GB	300GB	450GB	600GB
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	529	814	1066	-	-	-	-	-	-
4	707	1086	1423	-	-	-	-	-	-
5	884	1358	1779	1061	1629	2135	-	-	-
6	1059	1628	2133	1274	1955	2563	-	-	-
7	1236	1900	2489	1487	2281	2990	-	-	-
8	1414	2172	2846	1700	2608	3418	-	-	-
9	1589	2442	3200	1912	2934	3845	2124	3260	4273
10	1766	2714	3556	2123	3258	4271	2360	3623	4748
11	1943	2986	3912	2336	3584	4698	2596	3985	5223
12	2119	3256	4267	2549	3911	5126	2833	4348	5698
13	2296	3528	4623	2761	4237	5553	3069	4710	6173
14	2473	3800	4979	2974	4563	5981	3305	5073	6648
15	2648	4070	5333	3185	4887	6406	3541	5435	7123
16	2826	4342	5690	3398	5214	6834	3778	5798	7598
17	3003	4614	6046	3610	5540	7261	4014	6160	8073
18	3178	4884	6400	3823	5866	7689	4248	6521	8546
19	3355	5156	6756	4036	6192	8116	4484	6883	9021
20	3533	5428	7113	4247	6517	8542	4721	7246	9496
21	3708	5698	7467	4459	6843	8969	4957	7608	9971
22	3885	5970	7823	4672	7169	9397	5193	7971	10446
23	4062	6242	8179	4885	7495	9824	5429	8333	10921
24	4238	6512	8534	5098	7822	10252	5666	8696	11396
25	4415	6784	8890	5308	8146	10677	5902	9058	11871
26	4592	7056	9246	5521	8472	11105	6138	9421	12346
27	4767	7326	9600	5734	8798	11532	6372	9781	12819
28	4945	7598	9957	5947	9125	11960	6609	10144	13294
29	5122	7870	10313	6159	9451	12387	6845	10506	13769
30	5297	8140	10667	6370	9775	12813	7081	10869	14244
31	5474	8412	11023	6583	10101	13240	7317	11231	14719
32	5652	8684	11380	6796	10428	13668	7554	11594	15194
33	5827	8954	11734	7008	10754	14095	7790	11956	15669
34	6004	9226	12090	7221	11080	14523	8026	12319	16144
35	6181	9498	12446	7432	11404	14948	8262	12681	16619
36	6357	9768	12801	7645	11731	15376	8497	13042	17092
37	6534	10040	13157	7857	12057	15803	8733	13404	17567
38	6711	10312	13513	8070	12383	16231	8969	13767	18042
39	6886	10582	13867	8283	12709	16658	9205	14129	18517
40	7064	10854	14224	8494	13034	17084	9442	14492	18992
41	7241	11126	14580	8706	13360	17511	9678	14854	19467
42	7416	11396	14934	8919	13686	17939	9914	15217	19942
43	7593	11668	15290	9132	14012	18366	10150	15579	20417
44	7771	11940	15647	9345	14339	18794	10387	15942	20892
45	7946	12210	16001	9555	14663	19219	10621	16302	21365
46	8123	12482	16357	9768	14989	19647	10857	16665	21840
47	8300	12754	16713	9981	15315	20074	11093	17027	22315
48	8476	13024	17068	10194	15642	20502	11330	17390	22790
49	8653	13296	17424	10406	15968	20929	11566	17752	23265

Appendix: Dynamic Pool Capacity List (3)

■ RAID Type: RAID-5(2+P/4+P/8+P) ■ Disk Drive Type: SAS ■ 1GB = 1024³ Byte

# of Disk Drive	RAID-5(2+P)			RAID-5(4+P)			RAID-5(8+P)		
	300GB	450GB	600GB	300GB	450GB	600GB	300GB	450GB	600GB
50	8830	13568	17780	10617	16292	21355	11802	18115	23740
51	9005	13838	18134	10830	16618	21782	12038	18477	24215
52	9183	14110	18491	11043	16945	22210	12275	18840	24690
53	9360	14382	18847	11255	17271	22637	12511	19202	25165
54	9535	14652	19201	11468	17597	23065	12745	19563	25638
55	9712	14924	19557	11679	17921	23490	12981	19925	26113
56	9890	15196	19914	11892	18248	23918	13218	20288	26588
57	10065	15466	20268	12104	18574	24345	13454	20650	27063
58	10242	15738	20624	12317	18900	24773	13690	21013	27538
59	10419	16010	20980	12530	19226	25200	13926	21375	28013
60	10595	16280	21335	12741	19551	25626	14163	21738	28488
61	10772	16552	21691	12953	19877	26053	14399	22100	28963
62	10949	16824	22047	13166	20203	26481	14635	22463	29438
63	11124	17094	22401	13379	20529	26908	14869	22823	29911
64	11302	17366	22758	13592	20856	27336	15106	23186	30386
65	11479	17638	23114	13802	21180	27761	15342	23548	30861
66	11654	17908	23468	14015	21506	28189	15578	23911	31336
67	11831	18180	23824	14228	21832	28616	15814	24273	31811
68	12009	18452	24181	14441	22159	29044	16051	24636	32286
69	12184	18722	24535	14653	22485	29471	16287	24998	32761
70	12361	18994	24891	14864	22809	29897	16523	25361	33236
71	12538	19266	25247	15077	23135	30324	16759	25723	33711
72	12714	19536	25602	15290	23462	30752	16994	26084	34184
73	12891	19808	25958	15502	23788	31179	17230	26446	34659
74	13068	20080	26314	15715	24114	31607	17466	26809	35134
75	13243	20350	26668	15926	24438	32032	17702	27171	35609
76	13421	20622	27025	16139	24765	32460	17939	27534	36084
77	13598	20894	27381	16351	25091	32887	18175	27896	36559
78	13773	21164	27735	16564	25417	33315	18411	28259	37034
79	13950	21436	28091	16777	25743	33742	18647	28621	37509
80	14128	21708	28448	16988	26068	34168	18884	28984	37984
81	14303	21978	28802	17200	26394	34595	19118	29344	38457
82	14480	22250	29158	17413	26720	35023	19354	29707	38932
83	14657	22522	29514	17626	27046	35450	19590	30069	39407
84	14833	22792	29869	17839	27373	35878	19827	30432	39882
85	15010	23064	30225	18049	27697	36303	20063	30794	40357
86	15187	23336	30581	18262	28023	36731	20299	31157	40832
87	15362	23606	30935	18475	28349	37158	20535	31519	41307
88	15540	23878	31292	18688	28676	37586	20772	31882	41782
89	15717	24150	31648	18900	29002	38013	21008	32244	42257
90	15892	24420	32002	19111	29326	38439	21242	32605	42730
91	16069	24692	32358	19324	29652	38866	21478	32967	43205
92	16247	24964	32715	19537	29979	39294	21715	33330	43680
93	16422	25234	33069	19749	30305	39721	21951	33692	44155
94	16599	25506	33425	19962	30631	40149	22187	34055	44630
95	16776	25778	33781	20173	30955	40574	22423	34417	45105
96	16952	26048	34136	20386	31282	41002	22660	34780	45580

Appendix: Dynamic Pool Capacity List (4)

■ RAID Type: RAID-6(4+PQ/8+PQ) ■ Disk Drive Type: SAS ■ 1GB = 1024³ Byte

# of Disk Drive	RAID-6(4+PQ)			RAID-6(8+PQ)		
	300GB	450GB	600GB	300GB	450GB	600GB
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	1061	1630	2135	-	-	-
7	1238	1902	2491	-	-	-
8	1416	2174	2848	-	-	-
9	1593	2446	3204	-	-	-
10	1770	2718	3560	2125	3260	4273
11	1947	2990	3916	2338	3586	4700
12	2123	3260	4271	2551	3913	5128
13	2300	3532	4627	2763	4239	5555
14	2477	3804	4983	2976	4565	5983
15	2654	4076	5339	3189	4891	6410
16	2832	4348	5696	3402	5218	6838
17	3009	4620	6052	3614	5544	7265
18	3184	4890	6406	3827	5870	7693
19	3361	5162	6762	4040	6196	8120
20	3539	5434	7119	4251	6521	8546
21	3716	5706	7475	4463	6847	8973
22	3893	5978	7831	4676	7173	9401
23	4070	6250	8187	4889	7499	9828
24	4246	6520	8542	5102	7826	10256
25	4423	6792	8898	5314	8152	10683
26	4600	7064	9254	5527	8478	11111
27	4777	7336	9610	5740	8804	11538
28	4955	7608	9967	5953	9131	11966
29	5132	7880	10323	6165	9457	12393
30	5307	8150	10677	6376	9781	12819
31	5484	8422	11033	6589	10107	13246
32	5662	8694	11390	6802	10434	13674
33	5839	8966	11746	7014	10760	14101
34	6016	9238	12102	7227	11086	14529
35	6193	9510	12458	7440	11412	14956
36	6369	9780	12813	7653	11739	15384
37	6546	10052	13169	7865	12065	15811
38	6723	10324	13525	8078	12391	16239
39	6900	10596	13881	8291	12717	16666
40	7078	10868	14238	8502	13042	17092
41	7255	11140	14594	8714	13368	17519
42	7430	11410	14948	8927	13694	17947
43	7607	11682	15304	9140	14020	18374
44	7785	11954	15661	9353	14347	18802
45	7962	12226	16017	9565	14673	19229
46	8139	12498	16373	9778	14999	19657
47	8316	12770	16729	9991	15325	20084
48	8492	13040	17084	10204	15652	20512
49	8669	13312	17440	10416	15978	20939
50	8846	13584	17796	10627	16302	21365

# of Disk Drive	RAID-6(4+PQ)			RAID-6(8+PQ)		
	300GB	450GB	600GB	300GB	450GB	600GB
51	9023	13856	18152	10840	16628	21792
52	9201	14128	18509	11053	16955	22220
53	9378	14400	18865	11265	17281	22647
54	9553	14670	19219	11478	17607	23075
55	9730	14942	19575	11691	17933	23502
56	9908	15214	19932	11904	18260	23930
57	10085	15486	20288	12116	18586	24357
58	10262	15758	20644	12329	18912	24785
59	10439	16030	21000	12542	19238	25212
60	10615	16300	21355	12753	19563	25638
61	10792	16572	21711	12965	19889	26065
62	10969	16844	22067	13178	20215	26493
63	11146	17116	22423	13391	20541	26920
64	11324	17388	22780	13604	20868	27348
65	11501	17660	23136	13816	21194	27775
66	11676	17930	23490	14029	21520	28203
67	11853	18202	23846	14242	21846	28630
68	12031	18474	24203	14455	22173	29058
69	12208	18746	24559	14667	22499	29485
70	12385	19018	24915	14878	22823	29911
71	12562	19290	25271	15091	23149	30338
72	12738	19560	25626	15304	23476	30766
73	12915	19832	25982	15516	23802	31193
74	13092	20104	26338	15729	24128	31621
75	13269	20376	26694	15942	24454	32048
76	13447	20648	27051	16155	24781	32476
77	13624	20920	27407	16367	25107	32903
78	13799	21190	27761	16580	25433	33331
79	13976	21462	28117	16793	25759	33758
80	14154	21734	28474	17004	26084	34184
81	14331	22006	28830	17216	26410	34611
82	14508	22278	29186	17429	26736	35039
83	14685	22550	29542	17642	27062	35466
84	14861	22820	29897	17855	27389	35894
85	15038	23092	30253	18067	27715	36321
86	15215	23364	30609	18280	28041	36749
87	15392	23636	30965	18493	28367	37176
88	15570	23908	31322	18706	28694	37604
89	15747	24180	31678	18918	29020	38031
90	15922	24450	32032	19129	29344	38457
91	16099	24722	32388	19342	29670	38884
92	16277	24994	32745	19555	29997	39312
93	16454	25266	33101	19767	30323	39739
94	16631	25538	33457	19980	30649	40167
95	16808	25810	33813	20193	30975	40594
96	16984	26080	34168	20406	31302	41022

Appendix: Dynamic Pool Capacity List (5)

■ RAID Type: RAID-1/RAID-TM ■ Disk Drive Type: NL-SAS ■ 1GB = 1024³ Byte

# of Disk Drive	RAID-1(1+1)		RAID-TM(1+1+1)	
	1000GB	2000GB	1000GB	2000GB
1	-	-	-	-
2	910	1817	-	-
3	1367	2727	912	1819
4	1821	3634	1217	2426
5	2278	4544	1521	3033
6	2731	5451	1824	3638
7	3188	6361	2129	4245
8	3642	7268	2434	4852
9	4099	8178	2736	5457
10	4552	9085	3041	6064
11	5009	9995	3346	6671
12	5463	10902	3649	7276
13	5920	11812	3953	7883
14	6373	12719	4258	8490
15	6830	13629	4561	9095
16	7284	14536	4866	9702
17	7741	15446	5170	10309
18	8194	16353	5473	10914
19	8651	17263	5778	11521
20	9105	18170	6083	12128
21	9562	19080	6385	12733
22	10015	19987	6690	13340
23	10472	20897	6995	13947
24	10926	21804	7298	14552
25	11383	22714	7602	15159
26	11836	23621	7907	15766
27	12293	24531	8210	16371
28	12747	25438	8515	16978
29	13204	26348	8819	17585
30	13657	27255	9122	18190
31	14114	28165	9427	18797
32	14568	29072	9732	19404
33	15025	29982	10034	20009
34	15478	30889	10339	20616
35	15935	31799	10644	21223
36	16389	32706	10947	21828
37	16846	33616	11251	22435
38	17299	34523	11556	23042
39	17756	35433	11859	23647
40	18210	36340	12164	24254
41	18667	37250	12468	24861
42	19120	38157	12771	25466
43	19577	39067	13076	26073
44	20031	39974	13381	26680
45	20488	40884	13683	27285
46	20941	41791	13988	27892
47	21398	42701	14293	28499
48	21852	43608	14596	29104
49	22309	44518	14900	29711
50	22762	45425	15205	30318

# of Disk Drive	RAID-1(1+1)		RAID-TM(1+1+1)	
	1000GB	2000GB	1000GB	2000GB
51	23219	46335	15508	30923
52	23673	47242	15813	31530
53	24130	48152	16117	32137
54	24583	49059	16420	32742
55	25040	49969	16725	33349
56	25494	50876	17030	33956
57	25951	51786	17332	34561
58	26404	52693	17637	35168
59	26861	53603	17942	35775
60	27315	54510	18245	36380
61	27772	55420	18549	36987
62	28225	56327	18854	37594
63	28682	57237	19157	38199
64	29136	58144	19462	38806
65	29593	59054	19766	39413
66	30046	59961	20069	40018
67	30503	60871	20374	40625
68	30957	61778	20679	41232
69	31414	62688	20981	41837
70	31867	63595	21286	42444
71	32324	64505	21591	43051
72	32778	65412	21894	43656
73	33235	66322	22198	44263
74	33688	67229	22503	44870
75	34145	68139	22806	45475
76	34599	69046	23111	46082
77	35056	69956	23415	46689
78	35509	70863	23718	47294
79	35966	71773	24023	47901
80	36420	72680	24328	48508
81	36877	73590	24630	49113
82	37330	74497	24935	49720
83	37787	75407	25240	50327
84	38241	76314	25543	50932
85	38698	77224	25847	51539
86	39151	78131	26152	52146
87	39608	79041	26455	52751
88	40062	79948	26760	53358
89	40519	80858	27064	53965
90	40972	81765	27367	54570
91	41429	82675	27672	55177
92	41883	83582	27977	55784
93	42340	84492	28279	56389
94	42793	85399	28584	56996
95	43250	86309	28889	57603
96	43704	87216	29192	58208

Appendix: Dynamic Pool Capacity List (6)

■ RAID Type: RAID-5(2+P/4+P/8+P) ■ Disk Drive Type: NL-SAS ■ 1GB = 1024³ Byte

# of Disk Drive	RAID-5(2+P)		RAID-5(4+P)		RAID-5(8+P)	
	1000GB	2000GB	1000GB	2000GB	1000GB	2000GB
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	1826	3640	-	-	-	-
4	2436	4854	-	-	-	-
5	3045	6068	3655	7281	-	-
6	3653	7280	4387	8738	-	-
7	4262	8494	5118	10195	-	-
8	4872	9708	5850	11652	-	-
9	5479	10920	6581	13108	7312	14564
10	6089	12134	7311	14563	8125	16183
11	6698	13348	8042	16020	8938	17801
12	7306	14560	8774	17477	9751	19420
13	7915	15774	9505	18933	10563	21038
14	8525	16988	10237	20390	11376	22657
15	9132	18200	10966	21845	12189	24275
16	9742	19414	11698	23302	13002	25894
17	10351	20628	12429	24758	13814	27512
18	10959	21840	13161	26215	14625	29129
19	11568	23054	13892	27672	15438	30747
20	12178	24268	14622	29127	16251	32366
21	12785	25480	15353	30583	17063	33984
22	13395	26694	16085	32040	17876	35603
23	14004	27908	16816	33497	18689	37221
24	14612	29120	17548	34954	19502	38840
25	15221	30334	18277	36408	20314	40458
26	15831	31548	19009	37865	21127	42077
27	16438	32760	19740	39322	21938	43693
28	17048	33974	20472	40779	22751	45312
29	17657	35188	21203	42235	23563	46930
30	18265	36400	21933	43690	24376	48549
31	18874	37614	22664	45147	25189	50167
32	19484	38828	23396	46604	26002	51786
33	20091	40040	24127	48060	26814	53404
34	20701	41254	24859	49517	27627	55023
35	21310	42468	25588	50972	28440	56641
36	21918	43680	26320	52429	29251	58258
37	22527	44894	27051	53885	30063	59876
38	23137	46108	27783	55342	30876	61495
39	23744	47320	28514	56799	31689	63113
40	24354	48534	29244	58254	32502	64732
41	24963	49748	29975	59710	33314	66350
42	25571	50960	30707	61167	34127	67969
43	26180	52174	31438	62624	34940	69587
44	26790	53388	32170	64081	35753	71206
45	27397	54600	32899	65535	36563	72822
46	28007	55814	33631	66992	37376	74441
47	28616	57028	34362	68449	38189	76059
48	29224	58240	35094	69906	39002	77678
49	29833	59454	35825	71362	39814	79296
50	30443	60668	36555	72817	40627	80915

# of Disk Drive	RAID-5(2+P)		RAID-5(4+P)		RAID-5(8+P)	
	1000GB	2000GB	1000GB	2000GB	1000GB	2000GB
51	31050	61880	37286	74274	41440	82533
52	31660	63094	38018	75731	42253	84152
53	32269	64308	38749	77187	43065	85770
54	32877	65520	39481	78644	43876	87387
55	33486	66734	40210	80099	44689	89005
56	34096	67948	40942	81556	45502	90624
57	34703	69160	41673	83012	46314	92242
58	35313	70374	42405	84469	47127	93861
59	35922	71588	43136	85926	47940	95479
60	36530	72800	43866	87381	48753	97098
61	37139	74014	44597	88837	49565	98716
62	37749	75228	45329	90294	50378	100335
63	38356	76440	46060	91751	51189	101951
64	38966	77654	46792	93208	52002	103570
65	39575	78868	47521	94662	52814	105188
66	40183	80080	48253	96119	53627	106807
67	40792	81294	48984	97576	54440	108425
68	41402	82508	49716	99033	55253	110044
69	42009	83720	50447	100489	56065	111662
70	42619	84934	51177	101944	56878	113281
71	43228	86148	51908	103401	57691	114899
72	43836	87360	52640	104858	58502	116516
73	44445	88574	53371	106314	59314	118134
74	45055	89788	54103	107771	60127	119753
75	45662	91000	54832	109226	60940	121371
76	46272	92214	55564	110683	61753	122990
77	46881	93428	56295	112139	62565	124608
78	47489	94640	57027	113596	63378	126227
79	48098	95854	57758	115053	64191	127845
80	48708	97068	58488	116508	65004	129464
81	49315	98280	59219	117964	65814	131080
82	49925	99494	59951	119421	66627	132699
83	50534	100708	60682	120878	67440	134317
84	51142	101920	61414	122335	68253	135936
85	51751	103134	62143	123789	69065	137554
86	52361	104348	62875	125246	69878	139173
87	52968	105560	63606	126703	70691	140791
88	53578	106774	64338	128160	71504	142410
89	54187	107988	65069	129616	72316	144028
90	54795	109200	65799	131071	73127	145645
91	55404	110414	66530	132528	73940	147263
92	56014	111628	67262	133985	74753	148882
93	56621	112840	67993	135441	75565	150500
94	57231	114054	68725	136898	76378	152119
95	57840	115268	69454	138353	77191	153737
96	58448	116480	70186	139810	78004	155356

Appendix: Dynamic Pool Capacity List (7)

■ RAID Type: RAID-6(4+PQ/8+PQ) ■ Disk Drive Type: NL-SAS ■ 1GB = 1024³ Byte

# of Disk Drive	RAID-6(4+PQ)		RAID-6(8+PQ)	
	1000GB	2000GB	1000GB	2000GB
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	3655	7282	-	-
7	4264	8496	-	-
8	4874	9710	-	-
9	5483	10924	-	-
10	6093	12138	7313	14565
11	6702	13352	8044	16022
12	7310	14564	8776	17479
13	7919	15778	9507	18935
14	8529	16992	10239	20392
15	9138	18206	10970	21849
16	9748	19420	11702	23306
17	10357	20634	12433	24762
18	10965	21846	13165	26219
19	11574	23060	13896	27676
20	12184	24274	14626	29131
21	12793	25488	15357	30587
22	13403	26702	16089	32044
23	14012	27916	16820	33501
24	14620	29128	17552	34958
25	15229	30342	18283	36414
26	15839	31556	19015	37871
27	16448	32770	19746	39328
28	17058	33984	20478	40785
29	17667	35198	21209	42241
30	18275	36410	21939	43696
31	18884	37624	22670	45153
32	19494	38838	23402	46610
33	20103	40052	24133	48066
34	20713	41266	24865	49523
35	21322	42480	25596	50980
36	21930	43692	26328	52437
37	22539	44906	27059	53893
38	23149	46120	27791	55350
39	23758	47334	28522	56807
40	24368	48548	29252	58262
41	24977	49762	29983	59718
42	25585	50974	30715	61175
43	26194	52188	31446	62632
44	26804	53402	32178	64089
45	27413	54616	32909	65545
46	28023	55830	33641	67002
47	28632	57044	34372	68459
48	29240	58256	35104	69916
49	29849	59470	35835	71372
50	30459	60684	36565	72827

# of Disk Drive	RAID-6(4+PQ)		RAID-6(8+PQ)	
	1000GB	2000GB	1000GB	2000GB
51	31068	61898	37296	74284
52	31678	63112	38028	75741
53	32287	64326	38759	77197
54	32895	65538	39491	78654
55	33504	66752	40222	80111
56	34114	67966	40954	81568
57	34723	69180	41685	83024
58	35333	70394	42417	84481
59	35942	71608	43148	85938
60	36550	72820	43878	87393
61	37159	74034	44609	88849
62	37769	75248	45341	90306
63	38378	76462	46072	91763
64	38988	77676	46804	93220
65	39597	78890	47535	94676
66	40205	80102	48267	96133
67	40814	81316	48998	97590
68	41424	82530	49730	99047
69	42033	83744	50461	100503
70	42643	84958	51191	101958
71	43252	86172	51922	103415
72	43860	87384	52654	104872
73	44469	88598	53385	106328
74	45079	89812	54117	107785
75	45688	91026	54848	109242
76	46298	92240	55580	110699
77	46907	93454	56311	112155
78	47515	94666	57043	113612
79	48124	95880	57774	115069
80	48734	97094	58504	116524
81	49343	98308	59235	117980
82	49953	99522	59967	119437
83	50562	100736	60698	120894
84	51170	101948	61430	122351
85	51779	103162	62161	123807
86	52389	104376	62893	125264
87	52998	105590	63624	126721
88	53608	106804	64356	128178
89	54217	108018	65087	129634
90	54825	109230	65817	131089
91	55434	110444	66548	132546
92	56044	111658	67280	134003
93	56653	112872	68011	135459
94	57263	114086	68743	136916
95	57872	115300	69474	138373
96	58480	116512	70206	139830

Appendix: Dynamic Pool Capacity List (8)

■ RAID Type: RAID-1/RAID-TM ■ Disk Drive Type: SSD ■ 1GB = 1024³ Byte

# of Disk Drive	RAID-1(1+1)		RAID-TM(1+1+1)	
	1000GB	2000GB	1000GB	2000GB
1	-	-	-	-
2	83	360	-	-
3	127	542	85	362
4	167	721	114	484
5	210	903	143	605
6	250	1081	170	725
7	294	1263	199	846
8	334	1442	228	968
9	377	1624	255	1087
10	417	1802	284	1209
11	461	1984	313	1330
12	501	2163	340	1450
13	544	2345	369	1571
14	584	2523	398	1693

Appendix: Dynamic Pool Capacity List (9)

■ RAID Type: RAID-5(2+P/4+P/8+P) ■ Disk Drive Type: SSD ■ 1GB = 1024³ Byte

# of Disk Drive	RAID-5(2+P)		RAID-5(4+P)		RAID-5(8+P)	
	100GB	400GB	100GB	400GB	100GB	400GB
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	172	727	-	-	-	-
4	231	970	-	-	-	-
5	289	1213	348	1455	-	-
6	345	1454	418	1747	-	-
7	403	1697	488	2038	-	-
8	462	1940	558	2330	-	-
9	518	2181	628	2621	697	2914
10	576	2424	696	2911	775	3238
11	634	2667	766	3202	853	3562
12	691	2908	836	3494	931	3886
13	749	3151	906	3785	1008	4210
14	807	3394	976	4077	1086	4534

Appendix: Dynamic Pool Capacity List (10)

■ RAID Type: RAID-6(4+PQ/8+PQ) ■ Disk Drive Type: SSD ■ 1GB = 1024³ Byte

# of Disk Drive	RAID-6(4+PQ)		RAID-6(8+PQ)	
	100GB	400GB	100GB	400GB
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	347	1456	-	-
7	405	1699	-	-
8	464	1942	-	-
9	522	2185	-	-
10	580	2428	698	2913
11	638	2671	768	3204
12	695	2912	838	3496
13	753	3155	908	3787
14	811	3398	978	4079

Appendix: Dynamic Pool Capacity List (11)

■ RAID Type: RAID-1/RAID-TM ■ Disk Drive Type: SAS ■ 1GB = 1000³ Byte

# of Disk Drive	RAID-1(1+1)			RAID-TM(1+1+1)		
	300GB	450GB	600GB	300GB	450GB	600GB
1	-	-	-	-	-	-
2	281	433	569	-	-	-
3	424	652	856	282	435	571
4	562	867	1139	377	581	762
5	705	1086	1426	472	727	953
6	843	1301	1708	565	871	1142
7	986	1520	1995	660	1017	1333
8	1125	1735	2278	755	1163	1524
9	1268	1954	2565	848	1307	1713
10	1406	2168	2848	943	1453	1904
11	1549	2388	3135	1038	1599	2095
12	1687	2602	3417	1131	1743	2284
13	1830	2821	3704	1226	1889	2476
14	1969	3036	3987	1321	2035	2667
15	2112	3255	4274	1414	2179	2856
16	2250	3470	4556	1509	2325	3047
17	2393	3689	4843	1604	2471	3238
18	2531	3904	5126	1697	2615	3427
19	2674	4123	5413	1792	2761	3618
20	2813	4337	5696	1887	2907	3809
21	2956	4556	5983	1980	3051	3998
22	3094	4771	6265	2075	3197	4189
23	3237	4990	6552	2170	3343	4380
24	3375	5205	6835	2263	3487	4569
25	3518	5424	7122	2358	3633	4760
26	3657	5639	7405	2453	3779	4952
27	3799	5858	7692	2546	3923	5141
28	3938	6073	7974	2641	4069	5332
29	4081	6292	8261	2736	4215	5523
30	4219	6506	8544	2829	4359	5712
31	4362	6725	8831	2924	4505	5903
32	4501	6940	9113	3019	4651	6094
33	4643	7159	9400	3112	4795	6283
34	4782	7374	9683	3207	4941	6474
35	4925	7593	9970	3302	5087	6665
36	5063	7808	10253	3395	5231	6854
37	5206	8027	10540	3490	5377	7045
38	5345	8242	10822	3585	5523	7237
39	5487	8461	11109	3678	5667	7425
40	5626	8675	11392	3773	5813	7617
41	5769	8894	11679	3868	5959	7808
42	5907	9109	11962	3961	6103	7997
43	6050	9328	12248	4056	6249	8188
44	6189	9543	12531	4151	6395	8379
45	6331	9762	12818	4243	6539	8568
46	6470	9977	13101	4338	6685	8759
47	6613	10196	13388	4434	6831	8950
48	6751	10411	13670	4526	6975	9139
49	6894	10630	13957	4621	7121	9330
50	7033	10844	14240	4716	7267	9521

# of Disk Drive	RAID-1(1+1)			RAID-TM(1+1+1)		
	300GB	450GB	600GB	300GB	450GB	600GB
51	7175	11063	14527	4809	7410	9710
52	7314	11278	14810	4904	7556	9902
53	7457	11497	15097	4999	7703	10093
54	7595	11712	15379	5092	7846	10282
55	7738	11931	15666	5187	7992	10473
56	7876	12146	15949	5282	8138	10664
57	8019	12365	16236	5375	8282	10853
58	8158	12579	16518	5470	8428	11044
59	8301	12799	16805	5565	8574	11235
60	8439	13013	17088	5658	8718	11424
61	8582	13232	17375	5753	8864	11615
62	8720	13447	17658	5848	9010	11806
63	8863	13666	17945	5941	9154	11995
64	9002	13881	18227	6036	9300	12186
65	9145	14100	18514	6131	9446	12378
66	9283	14315	18797	6224	9590	12567
67	9426	14534	19084	6319	9736	12758
68	9564	14748	19367	6414	9882	12949
69	9707	14967	19654	6507	10026	13138
70	9846	15182	19936	6602	10172	13329
71	9989	15401	20223	6697	10318	13520
72	10127	15616	20506	6790	10462	13709
73	10270	15835	20793	6885	10608	13900
74	10408	16050	21075	6980	10754	14091
75	10551	16269	21362	7073	10898	14280
76	10690	16484	21645	7168	11044	14471
77	10832	16703	21932	7263	11190	14663
78	10971	16917	22215	7356	11334	14851
79	11114	17136	22502	7451	11480	15043
80	11252	17351	22784	7546	11626	15234
81	11395	17570	23071	7639	11770	15423
82	11534	17785	23354	7734	11916	15614
83	11676	18004	23641	7829	12062	15805
84	11815	18219	23924	7922	12206	15994
85	11958	18438	24210	8017	12352	16185
86	12096	18653	24493	8112	12498	16376
87	12239	18872	24780	8204	12642	16565
88	12378	19086	25063	8300	12788	16756
89	12520	19305	25350	8395	12934	16947
90	12659	19520	25632	8487	13078	17136
91	12802	19739	25919	8582	13224	17328
92	12940	19954	26202	8677	13370	17519
93	13083	20173	26489	8770	13514	17708
94	13222	20388	26772	8865	13660	17899
95	13364	20607	27059	8960	13806	18090
96	13503	20822	27341	9053	13950	18279

Appendix: Dynamic Pool Capacity List (12)

■ RAID Type: RAID-5(2+P/4+P/8+P) ■ Disk Drive Type: SAS ■ 1GB = 1000³ Byte

# of Disk Drive	RAID-5(2+P)			RAID-5(4+P)			RAID-5(8+P)		
	300GB	450GB	600GB	300GB	450GB	600GB	300GB	450GB	600GB
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	568	874	1145	-	-	-	-	-	-
4	759	1166	1527	-	-	-	-	-	-
5	949	1458	1910	1140	1749	2292	-	-	-
6	1137	1748	2290	1368	2099	2752	-	-	-
7	1327	2040	2673	1596	2450	3211	-	-	-
8	1518	2332	3055	1825	2800	3670	-	-	-
9	1706	2622	3436	2053	3150	4129	2280	3500	4588
10	1896	2914	3818	2280	3498	4585	2534	3890	5098
11	2087	3206	4201	2508	3849	5044	2788	4279	5608
12	2275	3496	4581	2736	4199	5504	3041	4668	6118
13	2465	3788	4964	2965	4549	5963	3295	5057	6628
14	2655	4080	5346	3193	4900	6422	3549	5447	7138
15	2844	4370	5727	3420	5248	6878	3802	5836	7648
16	3034	4662	6109	3648	5598	7337	4056	6225	8158
17	3224	4954	6492	3877	5948	7796	4310	6614	8668
18	3412	5244	6872	4105	6299	8256	4561	7001	9176
19	3603	5536	7255	4333	6649	8715	4815	7391	9686
20	3793	5828	7637	4560	6997	9171	5069	7780	10196
21	3981	6118	8017	4788	7347	9630	5322	8169	10706
22	4172	6410	8400	5017	7698	10089	5576	8558	11216
23	4362	6702	8782	5245	8048	10548	5830	8948	11726
24	4550	6992	9163	5473	8398	11008	6083	9337	12236
25	4740	7284	9545	5700	8746	11464	6337	9726	12746
26	4931	7576	9928	5928	9097	11923	6591	10115	13256
27	5119	7866	10308	6157	9447	12382	6842	10502	13764
28	5309	8158	10691	6385	9797	12841	7096	10892	14274
29	5499	8450	11073	6613	10148	13300	7350	11281	14784
30	5688	8740	11454	6840	10496	13757	7603	11670	15294
31	5878	9032	11836	7068	10846	14216	7857	12059	15804
32	6068	9324	12219	7297	11196	14675	8111	12448	16314
33	6256	9614	12599	7525	11547	15134	8364	12838	16824
34	6447	9906	12982	7754	11897	15593	8618	13227	17334
35	6637	10198	13364	7980	12245	16050	8872	13616	17844
36	6825	10488	13744	8208	12596	16509	9123	14003	18352
37	7016	10780	14127	8437	12946	16968	9377	14392	18862
38	7206	11072	14510	8665	13296	17427	9630	14782	19372
39	7394	11362	14890	8894	13646	17886	9884	15171	19882
40	7584	11654	15272	9120	13995	18343	10138	15560	20392
41	7775	11946	15655	9348	14345	18802	10391	15949	20902
42	7963	12236	16035	9577	14695	19261	10645	16339	21412
43	8153	12528	16418	9805	15046	19720	10899	16728	21922
44	8344	12820	16800	10034	15396	20179	11152	17117	22432
45	8532	13110	17181	10260	15744	20636	11404	17504	22940
46	8722	13402	17563	10488	16094	21095	11658	17893	23450
47	8912	13694	17946	10717	16445	21554	11911	18283	23960
48	9101	13984	18326	10945	16795	22013	12165	18672	24470
49	9291	14276	18709	11174	17145	22472	12419	19061	24980

Appendix: Dynamic Pool Capacity List (13)

■ RAID Type: RAID-5(2+P/4+P/8+P) ■ Disk Drive Type: SAS ■ 1GB = 1000³ Byte

# of Disk Drive	RAID-5(2+P)			RAID-5(4+P)			RAID-5(8+P)		
	300GB	450GB	600GB	300GB	450GB	600GB	300GB	450GB	600GB
50	9481	14568	19091	11400	17493	22929	12672	19450	25490
51	9669	14858	19472	11628	17844	23388	12926	19840	26000
52	9860	15150	19854	11857	18194	23847	13180	20229	26510
53	10050	15442	20237	12085	18544	24306	13433	20618	27020
54	10238	15732	20617	12314	18895	24765	13685	21005	27528
55	10428	16024	20999	12540	19243	25222	13939	21394	28038
56	10619	16316	21382	12768	19593	25681	14192	21784	28548
57	10807	16606	21762	12997	19943	26140	14446	22173	29058
58	10997	16898	22145	13225	20294	26599	14700	22562	29568
59	11188	17190	22527	13454	20644	27058	14953	22951	30078
60	11376	17480	22908	13680	20992	27515	15207	23340	30588
61	11566	17772	23290	13908	21343	27974	15461	23730	31098
62	11756	18064	23673	14137	21693	28433	15714	24119	31608
63	11945	18354	24053	14365	22043	28892	15966	24506	32116
64	12135	18646	24436	14594	22393	29351	16219	24895	32626
65	12325	18938	24818	14820	22742	29808	16473	25285	33136
66	12513	19228	25199	15049	23092	30267	16727	25674	33646
67	12704	19520	25581	15277	23442	30726	16980	26063	34156
68	12894	19812	25964	15505	23793	31185	17234	26452	34666
69	13082	20102	26344	15734	24143	31644	17488	26841	35176
70	13273	20394	26727	15960	24491	32101	17741	27231	35686
71	13463	20686	27109	16189	24841	32560	17995	27620	36196
72	13651	20976	27489	16417	25192	33019	18247	28007	36704
73	13841	21268	27872	16645	25542	33478	18500	28396	37214
74	14032	21560	28254	16874	25892	33937	18754	28785	37724
75	14220	21850	28635	17100	26240	34394	19008	29175	38234
76	14410	22142	29017	17329	26591	34853	19261	29564	38744
77	14601	22434	29400	17557	26941	35312	19515	29953	39254
78	14789	22724	29780	17785	27291	35771	19769	30342	39764
79	14979	23016	30163	18014	27642	36230	20022	30732	40274
80	15169	23308	30545	18240	27990	36687	20276	31121	40785
81	15357	23598	30926	18469	28340	37146	20528	31508	41292
82	15548	23890	31308	18697	28690	37605	20781	31897	41802
83	15738	24182	31691	18926	29041	38064	21035	32286	42312
84	15926	24472	32071	19154	29391	38523	21289	32676	42822
85	16117	24764	32454	19380	29739	38980	21542	33065	43332
86	16307	25056	32836	19609	30090	39439	21796	33454	43843
87	16495	25346	33217	19837	30440	39898	22050	33843	44353
88	16685	25638	33599	20066	30790	40357	22303	34233	44863
89	16876	25930	33982	20294	31140	40816	22557	34622	45373
90	17064	26220	34362	20520	31489	41273	22808	35009	45880
91	17254	26512	34744	20749	31839	41732	23062	35398	46391
92	17445	26804	35127	20977	32189	42191	23316	35787	46901
93	17633	27094	35507	21206	32540	42650	23569	36177	47411
94	17823	27386	35890	21434	32890	43109	23823	36566	47921
95	18013	27678	36272	21660	33238	43566	24077	36955	48431
96	18202	27968	36653	21889	33588	44025	24330	37344	48941

Appendix: Dynamic Pool Capacity List (14)

■ RAID Type: RAID-6(4+PQ/8+PQ) ■ Disk Drive Type: SAS ■ 1GB = 1000³ Byte

# of Disk Drive	RAID-6(4+PQ)			RAID-6(8+PQ)		
	300GB	450GB	600GB	300GB	450GB	600GB
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	1139	1750	2292	-	-	-
7	1330	2042	2675	-	-	-
8	1520	2334	3058	-	-	-
9	1710	2626	3440	-	-	-
10	1901	2918	3823	2282	3500	4588
11	2091	3210	4205	2510	3851	5047
12	2279	3500	4585	2739	4201	5506
13	2469	3792	4968	2967	4551	5965
14	2660	4084	5350	3195	4902	6424
15	2850	4376	5733	3424	5252	6883
16	3040	4668	6116	3652	5602	7342
17	3231	4960	6498	3881	5953	7801
18	3419	5250	6878	4109	6303	8260
19	3609	5542	7261	4338	6653	8719
20	3799	5834	7643	4564	7001	9176
21	3990	6126	8026	4792	7352	9635
22	4180	6418	8409	5021	7702	10094
23	4370	6710	8791	5249	8052	10553
24	4559	7000	9171	5478	8403	11012
25	4749	7292	9554	5706	8753	11471
26	4939	7584	9936	5935	9103	11930
27	5130	7876	10319	6163	9454	12389
28	5320	8169	10701	6391	9804	12848
29	5510	8461	11084	6620	10154	13307
30	5698	8750	11464	6846	10502	13764
31	5889	9043	11847	7075	10853	14223
32	6079	9335	12229	7303	11203	14682
33	6269	9627	12612	7532	11553	15141
34	6460	9919	12994	7760	11904	15600
35	6650	10211	13377	7988	12254	16059
36	6838	10501	13757	8217	12604	16518
37	7028	10793	14140	8445	12954	16977
38	7219	11085	14522	8674	13305	17436
39	7409	11377	14905	8902	13655	17895
40	7599	11669	15287	9128	14003	18352
41	7790	11961	15670	9357	14354	18811
42	7978	12251	16050	9585	14704	19270
43	8168	12543	16433	9814	15054	19729
44	8359	12835	16815	10042	15404	20188
45	8549	13127	17198	10271	15755	20647
46	8739	13419	17580	10499	16105	21106
47	8930	13711	17963	10728	16455	21565
48	9118	14001	18343	10956	16806	22024
49	9308	14293	18726	11184	17156	22483
50	9498	14585	19108	11411	17504	22940

# of Disk Drive	RAID-6(4+PQ)			RAID-6(8+PQ)		
	300GB	450GB	600GB	300GB	450GB	600GB
51	9689	14877	19491	11639	17854	23399
52	9879	15169	19873	11868	18205	23858
53	10069	15461	20256	12096	18555	24317
54	10257	15751	20636	12324	18905	24776
55	10448	16043	21019	12553	19256	25235
56	10638	16335	21401	12781	19606	25694
57	10828	16627	21784	13010	19956	26153
58	11019	16920	22166	13238	20307	26612
59	11209	17212	22549	13467	20657	27071
60	11397	17501	22929	13693	21005	27528
61	11588	17794	23312	13921	21355	27987
62	11778	18086	23694	14150	21706	28446
63	11968	18378	24077	14378	22056	28905
64	12159	18670	24459	14607	22406	29364
65	12349	18962	24842	14835	22757	29823
66	12537	19252	25222	15064	23107	30282
67	12727	19544	25605	15292	23457	30741
68	12918	19836	25987	15520	23808	31200
69	13108	20128	26370	15749	24158	31659
70	13298	20420	26752	15975	24506	32116
71	13489	20712	27135	16204	24856	32575
72	13677	21002	27515	16432	25207	33034
73	13867	21294	27898	16660	25557	33493
74	14057	21586	28280	16889	25907	33952
75	14248	21878	28663	17117	26258	34411
76	14438	22170	29045	17346	26608	34870
77	14628	22462	29428	17574	26958	35329
78	14817	22752	29808	17803	27309	35788
79	15007	23044	30191	18031	27659	36247
80	15197	23336	30573	18257	28007	36704
81	15388	23628	30956	18486	28357	37163
82	15578	23920	31338	18714	28708	37622
83	15768	24212	31721	18943	29058	38081
84	15956	24502	32101	19171	29408	38540
85	16147	24794	32484	19400	29759	38999
86	16337	25086	32866	19628	30109	39458
87	16527	25378	33249	19856	30459	39917
88	16718	25671	33631	20085	30809	40376
89	16908	25963	34014	20313	31160	40836
90	17096	26252	34394	20540	31508	41292
91	17286	26545	34777	20768	31858	41751
92	17477	26837	35159	20997	32209	42210
93	17667	27129	35542	21225	32559	42669
94	17857	27421	35924	21453	32909	43128
95	18048	27713	36307	21682	33259	43588
96	18236	28003	36687	21910	33610	44047

Appendix: Dynamic Pool Capacity List (15)

■ RAID Type: RAID-1/RAID-TM ■ Disk Drive Type: NL-SAS ■ 1GB = 1000³ Byte

# of Disk Drive	RAID-1(1+1)		RAID-TM(1+1+1)	
	1000GB	2000GB	1000GB	2000GB
1	-	-	-	-
2	977	1950	-	-
3	1468	2928	979	1953
4	1955	3901	1306	2604
5	2446	4879	1633	3256
6	2932	5852	1959	3906
7	3423	6830	2286	4558
8	3910	7803	2613	5209
9	4401	8781	2938	5859
10	4888	9754	3265	6511
11	5379	10732	3593	7162
12	5865	11705	3918	7812
13	6356	12683	4245	8464
14	6843	13656	4572	9116
15	7334	14634	4897	9765
16	7821	15607	5224	10417
17	8312	16585	5552	11069
18	8798	17558	5877	11718
19	9289	18536	6204	12370
20	9776	19509	6531	13022
21	10267	20487	6856	13671
22	10754	21460	7183	14323
23	11245	22438	7511	14975
24	11731	23411	7836	15625
25	12222	24389	8163	16276
26	12709	25362	8490	16928
27	13200	26340	8815	17578
28	13686	27313	9142	18229
29	14177	28291	9470	18881
30	14664	29264	9795	19531
31	15155	30242	10122	20183
32	15642	31215	10449	20834
33	16133	32193	10774	21484
34	16619	33166	11101	22136
35	17110	34144	11429	22788
36	17597	35117	11754	23437
37	18088	36095	12081	24089
38	18575	37068	12408	24741
39	19066	38046	12733	25390
40	19552	39019	13060	26042
41	20043	39997	13388	26694
42	20530	40970	13713	27343
43	21021	41948	14040	27995
44	21508	42921	14367	28647
45	21999	43899	14692	29297
46	22485	44872	15020	29948
47	22976	45850	15347	30600
48	23463	46823	15672	31250
49	23954	47801	15999	31901
50	24441	48774	16326	32553

# of Disk Drive	RAID-1(1+1)		RAID-TM(1+1+1)	
	1000GB	2000GB	1000GB	2000GB
51	24932	49752	16651	33203
52	25418	50725	16979	33855
53	25909	51703	17306	34506
54	26396	52676	17631	35156
55	26887	53654	17958	35808
56	27373	54627	18285	36459
57	27864	55605	18610	37109
58	28351	56578	18938	37761
59	28842	57556	19265	38413
60	29329	58529	19590	39062
61	29820	59507	19917	39714
62	30306	60480	20244	40366
63	30797	61458	20569	41015
64	31284	62431	20897	41667
65	31775	63409	21224	42319
66	32262	64382	21549	42969
67	32753	65360	21876	43620
68	33239	66333	22203	44272
69	33730	67311	22528	44922
70	34217	68284	22856	45573
71	34708	69262	23183	46225
72	35195	70235	23508	46875
73	35686	71213	23835	47527
74	36172	72186	24162	48178
75	36663	73164	24488	48828
76	37150	74137	24815	49480
77	37641	75115	25142	50131
78	38128	76088	25467	50781
79	38619	77066	25794	51433
80	39105	78039	26121	52085
81	39596	79017	26447	52734
82	40083	79990	26774	53386
83	40574	80968	27101	54038
84	41060	81941	27426	54687
85	41551	82919	27753	55339
86	42038	83892	28081	55991
87	42529	84870	28406	56640
88	43016	85843	28733	57292
89	43507	86821	29060	57944
90	43993	87794	29385	58594
91	44484	88772	29712	59245
92	44971	89745	30040	59897
93	45462	90723	30365	60547
94	45949	91696	30692	61198
95	46440	92674	31019	61850
96	46926	93647	31344	62500

Appendix: Dynamic Pool Capacity List (16)

■ RAID Type: RAID-5(2+P/4+P/8+P) ■ Disk Drive Type: NL-SAS ■ 1GB = 1000³ Byte

# of Disk Drive	RAID-5(2+P)		RAID-5(4+P)		RAID-5(8+P)	
	1000GB	2000GB	1000GB	2000GB	1000GB	2000GB
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	1961	3908	-	-	-	-
4	2615	5211	-	-	-	-
5	3270	6515	3925	7818	-	-
6	3922	7816	4710	9382	-	-
7	4576	9120	5495	10947	-	-
8	5231	10423	6281	12511	-	-
9	5883	11725	7066	14075	7852	15638
10	6538	13028	7850	15637	8724	17376
11	7192	14332	8635	17201	9597	19114
12	7844	15633	9421	18765	10470	20852
13	8499	16937	10206	20329	11342	22589
14	9153	18240	10991	21894	12215	24327
15	9805	19542	11775	23456	13088	26065
16	10460	20845	12560	25020	13960	27803
17	11114	22149	13346	26584	14833	29541
18	11767	23450	14131	28148	15704	31277
19	12421	24754	14916	29712	16576	33014
20	13076	26057	15700	31274	17449	34752
21	13728	27358	16485	32839	18322	36490
22	14382	28662	17271	34403	19194	38228
23	15037	29965	18056	35967	20067	39966
24	15689	31267	18842	37531	20940	41704
25	16343	32570	19625	39093	21812	43441
26	16998	33874	20410	40657	22685	45179
27	17650	35175	21196	42221	23556	46915
28	18305	36479	21981	43786	24428	48653
29	18959	37782	22767	45350	25301	50391
30	19611	39084	23550	46912	26174	52129
31	20266	40387	24335	48476	27046	53866
32	20920	41691	25121	50040	27919	55604
33	21573	42992	25906	51604	28792	57342
34	22227	44296	26692	53169	29664	59080
35	22881	45599	27475	54731	30537	60818
36	23534	46901	28260	56295	31408	62554
37	24188	48204	29046	57859	32280	64291
38	24843	49508	29831	59423	33153	66029
39	25495	50809	30617	60987	34026	67767
40	26149	52112	31400	62549	34898	69505
41	26804	53416	32185	64113	35771	71243
42	27456	54717	32971	65678	36644	72981
43	28111	56021	33756	67242	37516	74719
44	28765	57324	34542	68806	38389	76456
45	29417	58626	35325	70368	39260	78192
46	30072	59929	36111	71932	40132	79930
47	30726	61233	36896	73496	41005	81668
48	31379	62534	37681	75060	41878	83406
49	32033	63838	38467	76625	42750	85143
50	32687	65141	39250	78187	43623	86881

# of Disk Drive	RAID-5(2+P)		RAID-5(4+P)		RAID-5(8+P)	
	1000GB	2000GB	1000GB	2000GB	1000GB	2000GB
51	33340	66443	40036	79751	44496	88619
52	33994	67746	40821	81315	45368	90357
53	34649	69050	41606	82879	46241	92095
54	35301	70351	42392	84443	47112	93831
55	35955	71655	43175	86005	47984	95568
56	36610	72958	43961	87570	48857	97306
57	37262	74259	44746	89134	49730	99044
58	37917	75563	45532	90698	50602	100782
59	38571	76867	46317	92262	51475	102520
60	39223	78168	47100	93824	52348	104258
61	39878	79471	47886	95388	53220	105996
62	40532	80775	48671	96952	54093	107733
63	41184	82076	49457	98517	54964	109469
64	41839	83380	50242	100081	55836	111207
65	42493	84683	51025	101643	56709	112945
66	43146	85985	51811	103207	57582	114683
67	43800	87288	52596	104771	58454	116420
68	44455	88592	53382	106335	59327	118158
69	45107	89893	54167	107900	60200	119896
70	45761	91197	54950	109462	61072	121634
71	46416	92500	55736	111026	61945	123372
72	47068	93802	56521	112590	62816	125108
73	47722	95105	57307	114154	63688	126845
74	48377	96409	58092	115718	64561	128583
75	49029	97710	58875	117280	65434	130321
76	49684	99014	59661	118844	66306	132059
77	50338	100317	60446	120409	67179	133797
78	50990	101618	61232	121973	68052	135535
79	51645	102922	62017	123537	68924	137273
80	52299	104225	62801	125099	69797	139010
81	52952	105527	63586	126663	70668	140746
82	53606	106830	64371	128227	71540	142484
83	54261	108134	65157	129792	72413	144222
84	54913	109435	65942	131356	73286	145960
85	55567	110739	66726	132918	74158	147698
86	56222	112042	67511	134482	75031	149435
87	56874	113344	68296	136046	75904	151173
88	57528	114647	69082	137610	76776	152911
89	58183	115951	69867	139174	77649	154649
90	58835	117252	70651	140736	78520	156385
91	59490	118556	71436	142301	79392	158122
92	60144	119859	72222	143865	80265	159860
93	60796	121161	73007	145429	81138	161598
94	61451	122464	73792	146993	82010	163336
95	62105	123768	74576	148555	82883	165074
96	62758	125069	75361	150119	83756	166812

Appendix: Dynamic Pool Capacity List (17)

■ RAID Type: RAID-6(4+PQ/8+PQ) ■ Disk Drive Type: NL-SAS ■ 1GB = 1000³ Byte

# of Disk Drive	RAID-6(4+PQ)		RAID-6(8+PQ)	
	1000GB	2000GB	1000GB	2000GB
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	3924	7818	-	-
7	4578	9122	-	-
8	5233	10426	-	-
9	5887	11729	-	-
10	6542	13033	7852	15639
11	7196	14336	8637	17203
12	7849	15637	9423	18767
13	8503	16941	10208	20332
14	9157	18245	10994	21896
15	9812	19548	11779	23460
16	10466	20852	12564	25024
17	11121	22155	13350	26588
18	11773	23456	14135	28152
19	12428	24760	14921	29717
20	13082	26064	15704	31279
21	13736	27367	16489	32843
22	14391	28671	17275	34407
23	15045	29974	18060	35971
24	15698	31275	18846	37535
25	16352	32579	19631	39100
26	17006	33882	20417	40664
27	17661	35186	21202	42228
28	18315	36490	21988	43792
29	18970	37793	22773	45356
30	19622	39094	23556	46918
31	20277	40398	24342	48482
32	20931	41701	25127	50047
33	21585	43005	25913	51611
34	22240	44309	26698	53175
35	22894	45612	27484	54739
36	23547	46913	28269	56303
37	24201	48217	29054	57867
38	24856	49520	29840	59432
39	25510	50824	30625	60996
40	26164	52128	31409	62558
41	26819	53431	32194	64122
42	27471	54732	32979	65686
43	28126	56036	33765	67250
44	28780	57339	34550	68815
45	29435	58643	35336	70379
46	30089	59947	36121	71943
47	30743	61250	36907	73507
48	31396	62551	37692	75071
49	32050	63855	38478	76635
50	32705	65158	39261	78197

# of Disk Drive	RAID-6(4+PQ)		RAID-6(8+PQ)	
	1000GB	2000GB	1000GB	2000GB
51	33359	66462	40046	79762
52	34013	67765	40832	81326
53	34668	69069	41617	82890
54	35320	70370	42403	84454
55	35975	71674	43188	86018
56	36629	72977	43974	87582
57	37284	74281	44759	89147
58	37938	75584	45544	90711
59	38592	76888	46330	92275
60	39245	78189	47113	93837
61	39899	79493	47899	95401
62	40554	80796	48684	96965
63	41208	82100	49469	98530
64	41863	83403	50255	100094
65	42517	84707	51040	101658
66	43169	86008	51826	103222
67	43824	87312	52611	104786
68	44478	88615	53397	106350
69	45133	89919	54182	107915
70	45787	91222	54965	109477
71	46442	92526	55751	111041
72	47094	93827	56536	112605
73	47748	95131	57322	114169
74	48403	96434	58107	115733
75	49057	97738	58893	117297
76	49712	99041	59678	118862
77	50366	100345	60464	120426
78	51018	101646	61249	121990
79	51673	102950	62034	123554
80	52327	104253	62818	125116
81	52982	105557	63603	126680
82	53636	106860	64389	128245
83	54291	108164	65174	129809
84	54943	109465	65959	131373
85	55597	110769	66745	132937
86	56252	112072	67530	134501
87	56906	113376	68316	136065
88	57561	114679	69101	137630
89	58215	115983	69887	139194
90	58867	117284	70670	140756
91	59522	118588	71455	142320
92	60176	119891	72241	143884
93	60831	121195	73026	145448
94	61485	122498	73812	147012
95	62140	123802	74597	148577
96	62792	125103	75383	150141

Appendix: Dynamic Pool Capacity List (18)

■ RAID Type: RAID-1/RAID-TM ■ Disk Drive Type: SSD ■ 1GB = 1000³ Byte

# of Disk Drive	RAID-1(1+1)		RAID-TM(1+1+1)	
	1000GB	2000GB	1000GB	2000GB
1	-	-	-	-
2	89	387	-	-
3	136	582	91	389
4	179	774	122	519
5	226	969	153	650
6	268	1161	182	778
7	315	1356	213	908
8	358	1548	244	1039
9	405	1744	273	1167
10	448	1935	304	1298
11	495	2131	336	1428
12	537	2322	365	1556
13	584	2518	396	1687
14	627	2709	427	1817

Appendix: Dynamic Pool Capacity List (19)

■ RAID Type: RAID-5(2+P/4+P/8+P) ■ Disk Drive Type: SSD ■ 1GB = 1000³ Byte

# of Disk Drive	RAID-5(2+P)		RAID-5(4+P)		RAID-5(8+P)	
	100GB	400GB	100GB	400GB	100GB	400GB
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	185	780	-	-	-	-
4	248	1041	-	-	-	-
5	310	1302	373	1562	-	-
6	370	1561	448	1875	-	-
7	433	1822	523	2188	-	-
8	496	2083	599	2501	-	-
9	556	2341	674	2814	749	3128
10	619	2602	747	3125	832	3476
11	681	2863	822	3438	916	3824
12	741	3122	897	3751	999	4172
13	804	3383	972	4064	1083	4520
14	867	3644	1047	4377	1166	4868

Appendix: Dynamic Pool Capacity List (20)

■ RAID Type: RAID-6(4+PQ/8+PQ) ■ Disk Drive Type: SSD ■ 1GB = 1000³ Byte

# of Disk Drive	RAID-6(4+PQ)		RAID-6(8+PQ)	
	100GB	400GB	100GB	400GB
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	373	1563	-	-
7	435	1824	-	-
8	498	2085	-	-
9	560	2346	-	-
10	623	2607	749	3127
11	685	2867	824	3440
12	746	3126	899	3753
13	808	3387	974	4066
14	871	3648	1050	4379